

# **IC-2A/AT/E**

144MHz FM TRANSCEIVER

## **INSTRUCTION MANUAL**



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## **SECTION I INTRODUCTION**

### **SYNTHESIZED HAND HELD TRANSCEIVER**

Small, light, and 800 channels capability,\* a handy for use any time, whether outdoors, in a car, or at home, 800 channels for use on any 2 meter frequency, or any repeater.

- \* IC-2Au      800 channels
- IC-2Ao      800 channels
- IC-2AT      800 channels with Touch Tone Encoder
- IC-2EDL    400 channels with Independent Tone Type
- IC-2EI      800 channels with Independent Tone Type

### **DUAL POWER LEVEL**

Transmitter output can be switched easily to either of two levels; 1.5W output HIGH for long distances, and 0.15W LOW for short distances. Battery consumption is minimized in the Low Power Mode. IC-BP5, Power Pack as option, gives 2.3W output.

### **VARIOUS POWER PACKS AVAILABLE**

The Power Pack is slipped on the bottom of the radio very easily, and various power packs are available to suit your needs, for minimum size, longer use, or higher power.

## SECTION II SPECIFICATIONS

### GENERAL

Number of Semi-conductors	Transistors	43 (42) < 41>
	FET	3
	IC	5 [6] (6)
	Diodes	21 (20)
Frequency Coverage	144.000 ~ 147.995MHz:	IC-2Au, IC-2Ao, IC-2AT, IC-2E1
	144.000 ~ 145.995MHz:	IC-2EDL
Frequency resolution	5KHz steps	800 channels or 400 channels
Frequency Control	Digital PLL synthesizer,	with thumb wheel switch
Frequency stability	Within $\pm 1.5$ KHz	
Usable Temperature	$-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$	( $14^{\circ}\text{F} \sim 140^{\circ}\text{F}$ )
Antenna impedance	50 ohms unbalanced	
Power supply requirement	DC 8.4V; with attendant power pack IC-BP3,	DC 6 ~ 12V
	negative ground is acceptable	
Current drain at 8.4V	Transmitting	
	HIGH : 1.5W	Approx. 550mA
	LOW : 0.15W	Approx. 220mA
	Receiving	
	At max audio output	Approx. 130mA
	Squelched	Approx. 20mA
Dimensions	116.5mm (H) x 65mm (W) x 35mm (D)	Without power pack
	Attendant power pack, IC-BP3	49mm (H) x 65mm (W) x 35mm (D)
Weight	470g [490g]	including power pack, IC-BP3 and flexible antenna



## TRANSMITTER

Output power	HIGH: 1.5W, LOW: 0.15W at 8.4V
Emission mode	16F <sub>3</sub>
Modulation system	Variable reactance frequency modulation
Max. frequency deviation	±5KHz
Spurious emission	More than 60dB below carrier
Microphone	Built-in Electret condenser microphone Optional Speaker-microphone can be used (IC-HM9)
Operating mode	Simplex Duplex ±600KHz from receive frequency

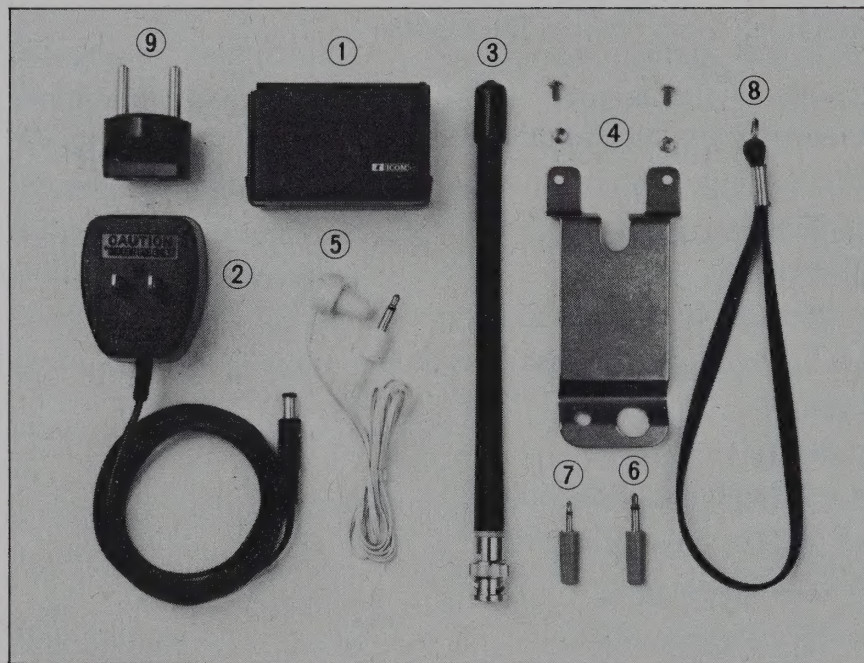
## RECEIVER

Receiving system	Double-conversion superheterodyne
Modulation acceptance	16F <sub>3</sub>
Intermediate frequency	1st: 10.695MHz 2nd: 455KHz
Sensitivity	More than 26dB S+N+D/N+D at 1μV Less than 0.5μV for 20dB Noise quieting
Squelch sensitivity	Less than 0.4μV
Spurious response rejection ratio	More than 60dB
Selectivity	More than ±7.5KHz at -6dB point Less than ±15KHz at -60dB point
Audio output power	More than 300mW
Audio output impedance	8 ohms

**Note:** [ ] Values for IC-2AT ( ) Values for IC-2Au and IC-2Ao < > Values for IC-2EDL and IC-2EI Specifications are approximate and are subject to change without notice or obligation.

## SECTION III ACCESSORIES

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Various accessories are packed with the transceiver. Make sure you have not overlooked anything.



- |  |   |
|--|---|
| 1. Power pack IC-BP3 . . . . .                     | 1 |
| 2. Wall charger BC-25U/E* . . . . .                | 1 |
| 3. Flexible antenna . . . . .                      | 1 |
| 4. Belt clip. . . . .                              | 1 |
| 5. Earphone. . . . .                               | 1 |
| 6. Earphone plug . . . . .                         | 1 |
| 7. Microphone plug. . . . .                        | 1 |
| 8. Hand-strap . . . . .                            | 1 |
| 9. Ac conversion plug (Universal type)** . . . . . | 1 |

\* BC-25U for 117V

\* BC-25E for 240V

\*\* for IC-2Ao, IC-2EDL and  
IC-2Ei only

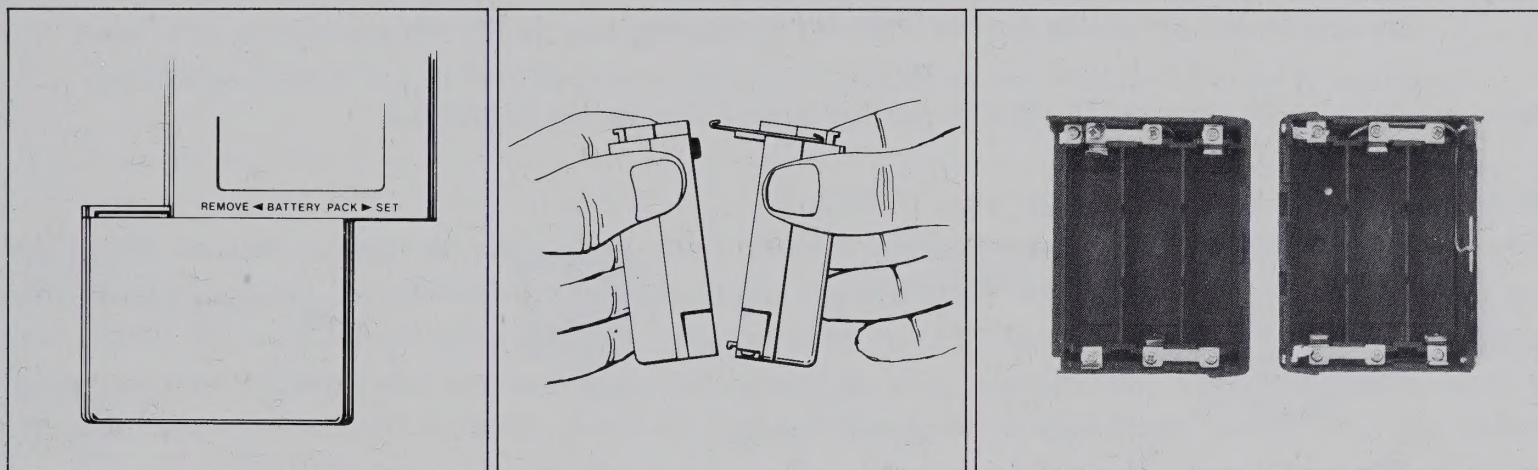


## SECTION IV PRE-OPERATION

### BATTERY INSTALLATION

When using alkaline power pack IC-BP4:

Place the power switch in the OFF position. Remove the power pack from bottom of the set by pushing the pack in the indicated direction. Separate the pack into two parts (case) as follows:



Each case holds three AA type batteries. Install batteries into each case, according to indicated polarity. With the batteries properly in place, carefully replace the pack and slip it onto the set with the reverse procedure.

Also, AA type Nickel-Cadmium, rechargeable, batteries can be used. But the charger for them should be the optional BC-30 charger.

## **WHEN TO REPLACE BATTERIES (When using alkaline batteries).**

When the Transmit Indicator LED does not light up during transmission, the batteries are exhausted. Use batteries of the same type, for mixed types might cause leakage. Replace worn batteries with a complete new set. If used with old batteries, the life of new ones might be shortened. Battery life is shortened more by transmitting than by receiving, since several times more current is drawn in transmit. To prolong battery life, therefore, practice as follows:

- \* Try to minimize the transmit period.
- \* Reduce volume during reception.
- \* Be sure to cut off power source when set is not used.

More working hours are available if high-performance batteries are employed.

When using Nickel-Cadmium power pack IC-BP3:

The IC-BP3 is a rechargeable Nickel-Cadmium power pack, and it can be slipped onto or off of the set very easily. It has a connector for a charger charge-current control circuit, reverse polarity protection circuit and charge indicator LED in its own pack. You can use the supplied BC-25U/E wall charger or similar simple wall charger, or a car battery by using optional cable IC-CP1 for recharging. Before use, the power pack should be charged about 15 hours, because the battery may have discharged. (Refer "How to charge" on page 7.)

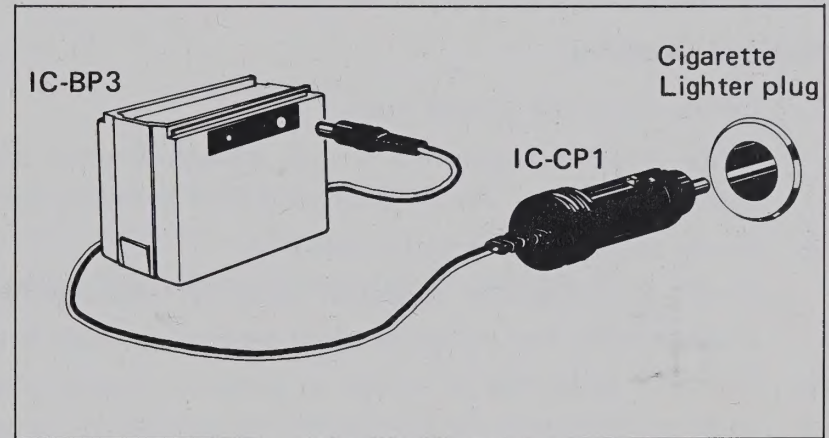
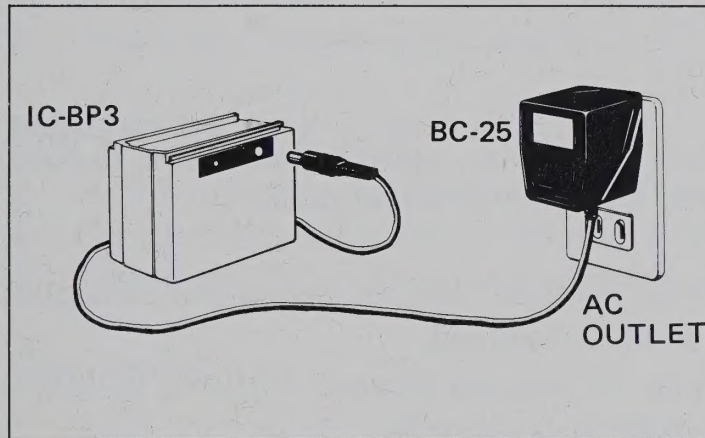
After charging is completed, the batteries can be used in the same manner as dry cells. However, the voltage of Nickel-Cadmium batteries drops rapidly just before they are exhausted, so when the Transmit Indicator LED of the transceiver goes out, be sure to immediately stop using it, and charge the batteries again.



## HOW TO CHARGE (When using Nickel-Cadmium power pack IC-BP3).

1. Use the supplied wall charger BC-25U/E or a stable power source with an output voltage of DC 13.8V and current capacity over 50mA, or use a 12V car battery with optional charger cable IC-CP1. (Output voltage of 12~15V can be used, but output voltage near the specified voltage should be used.)
2. The power switch of the transceiver must be OFF, or remove the power pack from the transceiver.
3. Connect the output plug of the wall charger (BC-25U/E), or other power source, to the charger socket of the power pack. (When charging Nickel-Cadmium batteries in the IC-BP4 power pack, you should use the BC-30 charger only.)

The charge indicator LED of the power pack is lit, which shows that the charger is working.



4. It takes about 15 hours to charge the batteries completely. This charger is designed for 0.1°C (10-hour rate current), but charge for 15 hours in order to compensate for any unbalance of the batteries.

You should charge the batteries for 15 hours when you have not used them for a long time or after buying them.

5. Charge between 0°C and 40°C.
6. Avoid continuing charging as much as possible after full charging, (15 hours). If excess charging is repeated, efficiency of the power pack is reduced.
7. After charging, unplug the plug of the power source from the charger socket of the power pack. The transceiver and the power pack is now ready for operation.

## **PRECAUTIONS FOR USE OF THE NICKEL-CADMIUM BATTERIES**

**(from the JIS C8705 MANUAL)**

### **General Cautions**

1. Never short the power pack.  
Since internal resistance is low, excess shorted current flows away, causing the batteries or conductors to burn. Avoid shorts! Label showing polarity is put on the power pack.
2. Never solder the batteries directly.  
If the batteries are soldered directly, the separator or insulator may be melted and damaged. Accordingly, the terminal must be spot-welded first and then soldered.
3. Confirm polarities in order to prevent reverse charging. If they are charged in reverse, batteries may be damaged. Therefore confirmation of correct polarity is essential.
4. Never charge with excess charging current.  
If an excess charging rate is employed, gas consumption speed cannot keep up with gas generating speed at the time of charging. Batteries may be damaged by increasing internal pressure. Accordingly, the charging must be kept regulated.



5. Avoid charging under 0°C or over 40°C.

Under 0°C, since gas consumption speed becomes lower at the charging time, inside pressure increases and hydrogen is generated. Since charging efficiency is reduced over 40°C, it is rather difficult to charge. Accordingly, charging must be done between 0°C and 40°C.

6. Never put batteries into fire.

Since there may be a little gas left in the batteries, internal pressure increases suddenly and the batteries explode if thrown into a fire. Also, battery electrolyte is ejected and can cause damage to skin and clothes.

## **FOR OUTDOOR USE**

1. Attach the supplied power pack. (Refer to "BATTERY INSTALLATION")
2. Attach the supplied hand strap and belt clip through the fixture on the body (as shown in the drawings on page 10).
3. Attach the flexible rubber antenna.

## **FOR USE IN THE CAR**

1. Avoid using the unit near the outlet of heaters, air-conditioners, etc.
2. Put the unit in a convenient place to avoid disrupting safe driving.
3. Firmly ground to the car body a mobile antenna (e.g. whip antenna) that requires it.

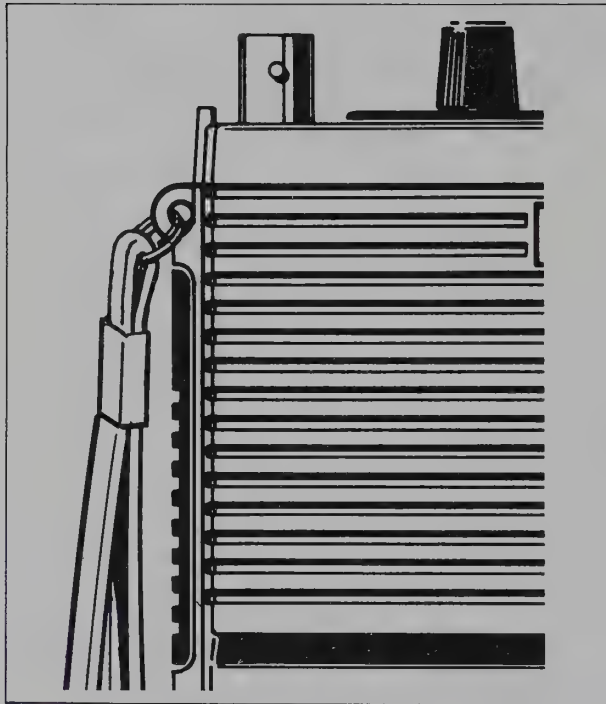
## **FOR FIXED USE**

1. Avoid putting the unit in places exposed to rain, water splash, direct sunshine, dust, vibration, or heat.
2. An external antenna should be used for indoor operation. The use of the flexible antenna indoors may cause TVI, BCI, Hi-Fi interference, malfunction of stabilized DC power supply.

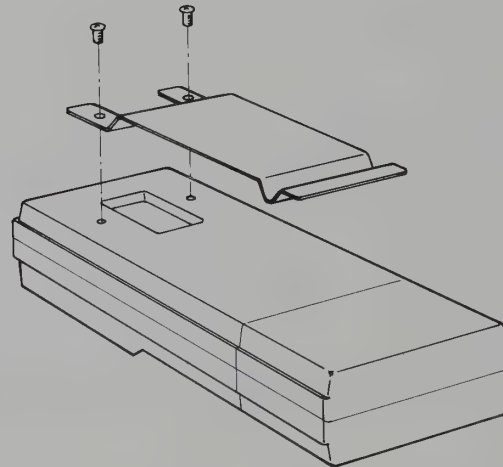
## EXTERNAL ANTENNA

1. Select a high performance antenna (a multi-element beam or gain antenna) and set it up in the highest possible position.
2. Use a 50 ohm antenna and coaxial cable.
3. On VHF, the power loss in the antenna cable is large, so use a cable with the lowest possible loss and make it as short as possible.
4. Use a BNC plug for connection to the unit.

## ATTACHMENT OF HAND STRAP AND BELT CLIP



- Attach the belt clip on the back cover with 2 screws supplied.

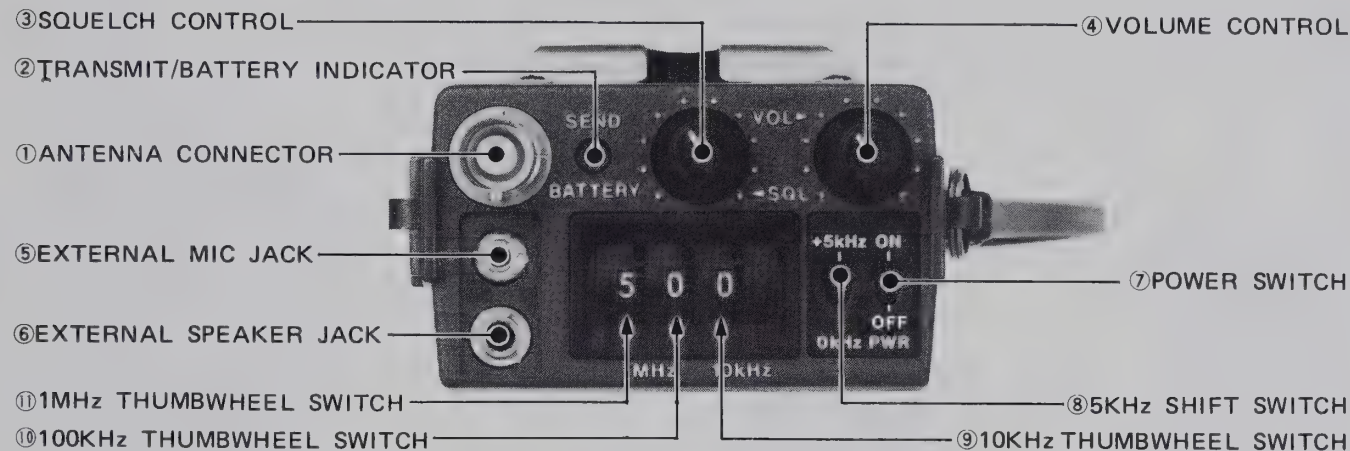




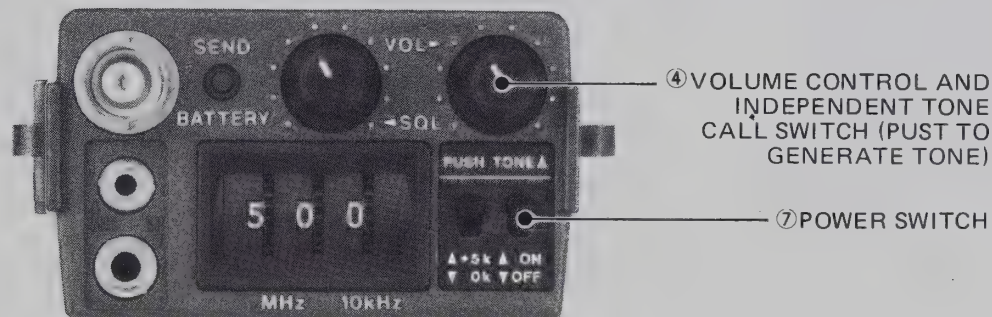
## SECTION V CONTROL FUNCTIONS

### TOP PANEL

[IC-2Au, IC-2Ao, IC-2AT]



[IC-2EdL, IC-2Ei]



FRONT PANEL

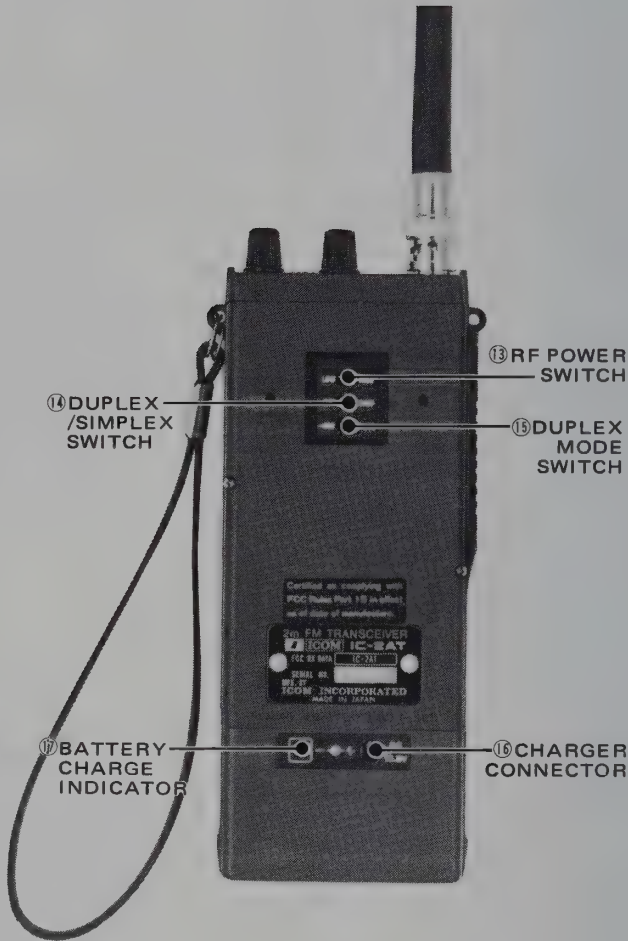
REAR PANEL



IC-2A, IC-2E



IC-2AT





① **ANTENNA CONNECTOR**

Connect the supplied flexible antenna. An external antenna can be used, using a BNC connector.

② **TRANSMIT/BATTERY INDICATOR**

Illuminates in the transmit mode. Also indicates the battery condition; during transmission. The voltage of Nickel-Cadmium batteries drops rapidly just before they are exhausted, so when this indicator goes out, be sure to immediately stop using it, and charge the batteries again.

③ **SQUELCH CONTROL**

Sets the squelch threshold level. To turn OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

④ **VOLUME CONTROL (and TONE CALL SWITCH)**

Controls the audio output level in the receive mode. Clockwise rotation increases audio output.

**TONE CALL SWITCH (IC-2E independent tone type only)**

Most repeaters require a 1750Hz Tone-burst for initial access. Depressing the VOLUME CONTROL knob for the required period for a repeater, puts the set in the transmit mode and the tone burst generator actuates and you can access the repeater.

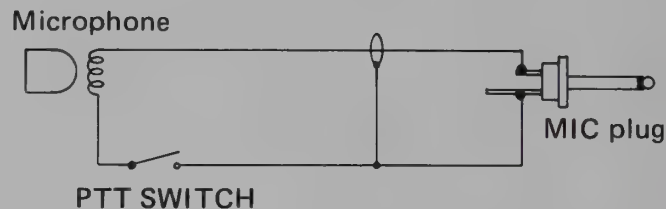
⑤ **EXTERNAL MIC JACK**

When an external microphone is used, connect it to this jack. See the schematic for the proper hookup. When the external microphone is connected the built-in microphone does not function. The IC-HM9 optional speaker-microphone can also be used.

### Electret condenser microphone



### Dynamic microphone



## ⑥ EXTERNAL SPEAKER JACK

When an external speaker (or an earphone) is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected the built-in speaker does not function.

## ⑦ POWER SWITCH

The ON/OFF switch controls the supplied power to the set.

## ⑧ 5KHz SHIFT SWITCH

When the desired operating frequency has a 5KHz digit, set this switch in the +5KHz position, and add 5KHz to the indicated frequency on the thumbwheel switches.



⑨ **10KHz THUMBWHEEL SWITCH**

Sets 10KHz digit of the desired operating frequency.

⑩ **100KHz THUMBWHEEL SWITCH**

Sets 100KHz digit of the desired operating frequency.

⑪ **1MHz THUMBWHEEL SWITCH**

Sets 1MHz digit of the desired operating frequency. When you set a digit of a frequency that is out of the band, the set will work as follows:

Digit	Actual Working frequency band	
	IC-2Au, IC-2Ao, IC-2AT, IC-2EI	IC-2EDL
0	144MHz	144MHz
1	145	145
2	146	144
3	147	145
4	144	144
5	145	145
6	146	144
7	147	145
8	144	144
9	145	145

⑫ **PUSH TO TALK (PTT) SWITCH**

For transmission, press this switch and talk into the microphone with normal voice. The internal microphone is of the electret-condenser type and provides good pickup for all levels of voice.

### **\*TWO-TONE ENCODER PAD**

IC-2AT has a standard two-tone encoder pad on the front panel. The pad can be used for auto-patch, accessing to closed repeater, and/or other controls.

#### **⑬ RF POWER SWITCH**

Selects the RF output power HIGH 1.5 Watt (at 8.4V) or LOW 0.15 Watt (at 8.4V). In the LOW position, the current drain is decreased, to prolong the battery life.

#### **⑭ DUPLEX/SIMPLEX SWITCH**

Selects the operation mode DUPLEX for repeater operation, or SIMPLEX for the same receive/transmit frequency operation.

#### **⑮ DUPLEX MODE SWITCH**

In the DUPLEX mode, selects the transmitting frequency, 600KHz above or below the receiving frequency according to the desired repeater input frequency.

#### **⑯ CHARGER CONNECTOR**

Connects to the output plug of the wall charger BC-25U/E or other power source.

#### **⑰ BATTERY CHARGE INDICATOR**

Lights during battery charging.



## SECTION VI OPERATION

### RECEIVING

Make sure the ⑧ POWER SWITCH is in the OFF position, and before turning ON the power switch, confirm as follows:

1. Make sure the power pack is properly charged and attached to the set.
2. Make sure the supplied flexible antenna is properly set.

When an external antenna is employed, make sure the coaxial line is of the correct impedance (50 ohms) and is neither shorted nor opened, and is firmly connected to the antenna connector.

Set the controls and switches as follows:

- |   |  |
|---|--|
| ③ SQUELCH CONTROL                               | Completely counterclockwise                                      |
| ④ VOLUME CONTROL                                | Completely counterclockwise                                      |
| ⑨~⑩ THUMBWHEEL SWITCHES and ⑦ 5KHz SHIFT SWITCH | Desired frequency<br>(Others may be at any position or setting.) |

Set the ⑧ power switch to the ON position.

Turn the ④ VOL control clockwise to a comfortable audio level.

If no signal can be heard but only noise, turn the ③ SQL control clockwise until the noise from the speaker stops and set it just below this threshold. (When adjusting the SQL setting, if some communication signals can be heard, turn the thumbwheel switch either direction and set it where only noise can be heard.) Your transceiver will now remain silent until an in-coming signal is received which opens the squelch. If the squelch is unstable due to the reception of weak or mobile stations, adjust the squelch control further until the proper threshold is obtained.

## TRANSMITTING

Set the controls and switches as follows:

- ⑭ DUPLEX/SIMPLEX SWITCH (see below)
- ⑮ DUPLEX MODE SWITCH (see below)
- ⑬ RF Power Switch HIGH

For simplex operation, set ⑭ DUPLEX/SIMPLEX SWITCH at the SIMPLEX position, making ⑮ DUPLEX MODE SWITCH nonfunctional.

For repeater operation, set ⑭ DUPLEX/SIMPLEX SWITCH at DUPLEX and select whether the transmitting frequency is to be 600KHz above (+600) or below (−600) the receiving frequency.

If the lower output power is sufficient, set ⑬ RF Power Switch to the LOW position.

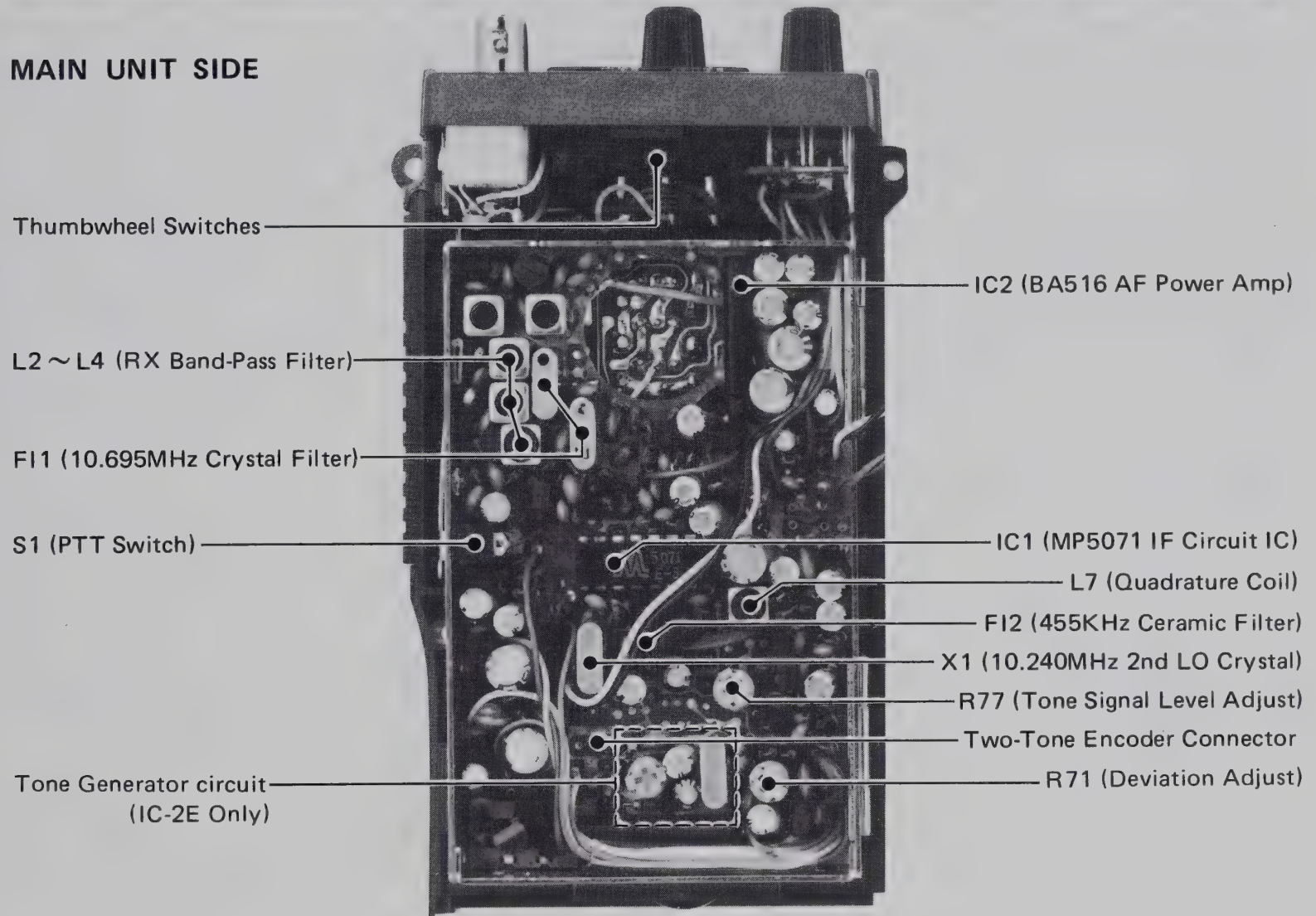
Depress the ⑫ PTT switch for transmitting and release for receiving. Speak into the microphone with your normal speech level for the proper microphone level.

If you need a tone-burst for initial access of the repeater, depress the ④ Tone Call Switch for the required period. (Tone-burst periods vary individually from 100 milliseconds to 2 seconds.)

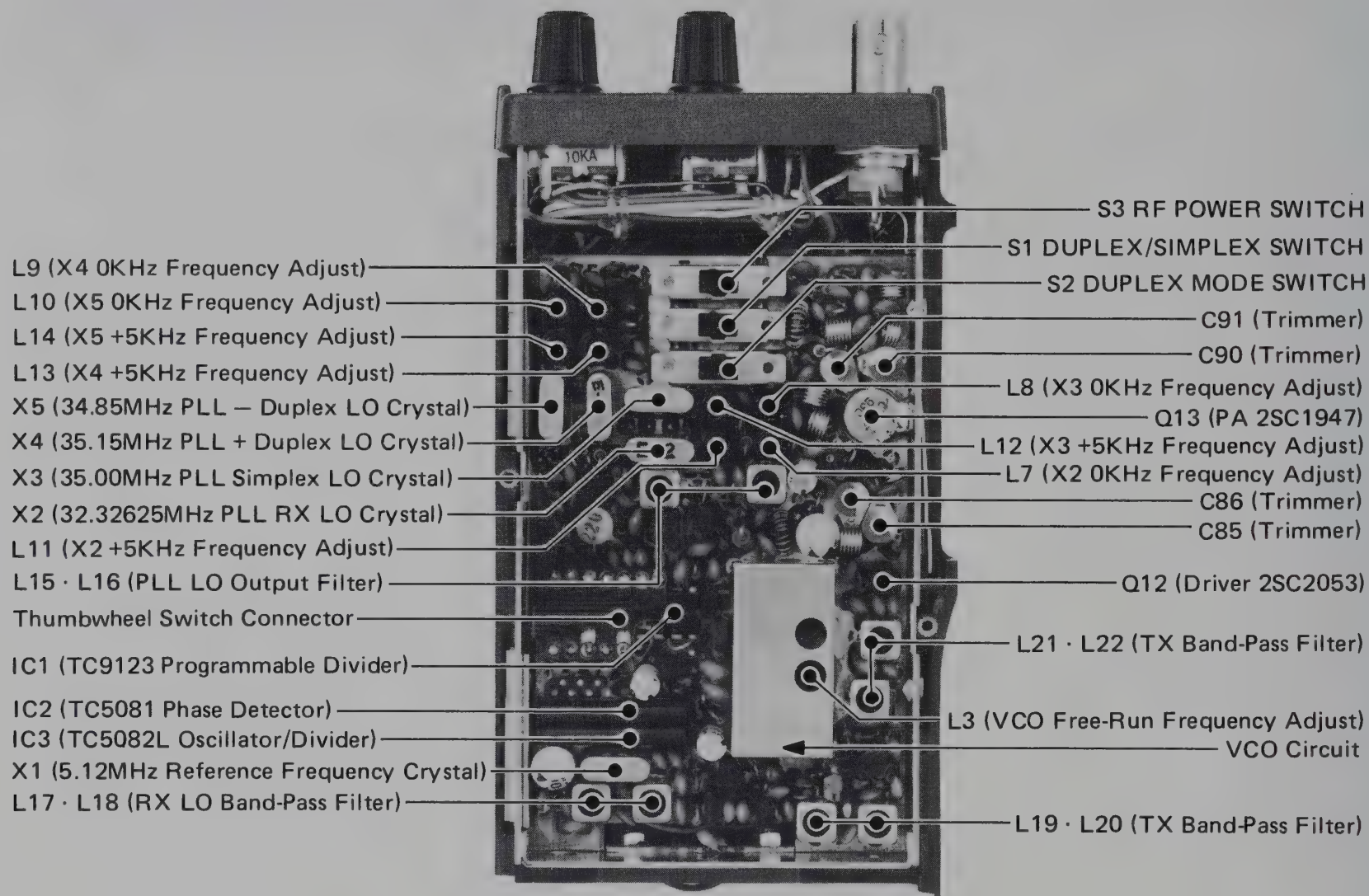


## SECTION VII INSIDE VIEW

### MAIN UNIT SIDE



## PLL UNIT SIDE





## SECTION VIII TROUBLE SHOOTING

Your IC-2A/AT/E has been tested very carefully at the factory before shipping. The chart below has been designed to help you correct any problems which are not equipment malfunctions. If you are not able to locate the problem and/or solve it through use of this chart, please contact your dealer or ICOM distributor for assistance.

Problem	Possible Cause	Solution
1. Power does not come ON when the switch is turned.	Bad connection of the power pack.	Check the connection of the power pack and correct any problems.
	Reverse polarity of the battery (when using IC-BP4)	Make sure of the polarity of each battery and replace them into the pack.
	The battery has been exhausted.	Replace the battery with a new one or recharge it.
2. No sound comes from the speaker.	VOLUME CONTROL knob is completely counterclockwise.	Turn the knob clockwise to a suitable level.
	The unit is in the transmit mode, by the PTT switch.	Put the unit in the receive mode.

Problem	Possible Cause	Solution
2. No sound comes from the speaker.	<p>SQUELCH setting is turned too far clockwise.</p> <p>External speaker (or earphone) is in use.</p> <p>The battery has been exhausted.</p>	<p>Turn the SQUELCH CONTROL counterclockwise until noise can be heard and reset it just below the threshold.</p> <p>Check if the external speaker plug is inserted properly or if the external speaker cable is cut.</p> <p>Replace the battery with a new one or recharge it.</p>
3. Sensitivity is low and only strong signals are audible.	<p>Bad connection of the flexible antenna.</p> <p>The antenna feed line is cut or shorted. (When using an external antenna.)</p>	<p>Check the connection of the antenna and correct any problems.</p> <p>Check the feed line and correct any improper condition.</p>
4. No or low RF output.	<p>RF Power switch is set at the Low position.</p> <p>The battery has been exhausted.</p> <p>The antenna feed line is cut or shorted.</p>	<p>Set the RF Power switch to the High position.</p> <p>Replace the battery with a new one or recharge it.</p> <p>Check the antenna feed line and correct any problems.</p>



Problem	Possible Cause	Solution
<p>5. No modulation. (When using external microphone.)</p>	<p>Bad connection of the MIC connector.</p> <p>The MIC cable is cut.</p>	<p>Check the connection of the MIC connector and correct any problems.</p> <p>Repair the disconnected or cut wire.</p>
<p>6. The receive mode functions properly and your signals are transmitted, but you are unable to make contact with another station. (When desiring DUPPLEX mode.)</p> <p>(When desiring, SIMPLEX mode.)</p>	<p>The DUPLEX/SIMPLEX Switch is in the SIMP position.</p> <p>Improper input/output frequency of the repeater.</p> <p>The DUPLEX/SIMPLEX Switch is in the DUP position.</p>	<p>Set the DUPLEX/SIMPLEX Switch in the DUP position, and the DUPLEX MODE Switch in +600 or –600 position according to repeater input/output frequency.</p> <p>Set the DUPLEX/SIMPLEX Switch in the SIMP position</p>

## SECTION IX VOLTAGE CHARTS

**NOTE:** Measuring instrument is a 50K $\Omega$ /V multimeter.

### MAIN UNIT TRANSISTORS

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q 1	0		0	GND	0.75		1.9	GND	
Q 2	0		0	0	2.2		5.5	1.9	
Q 3	0		0	0	0		5.4	1.6	
Q 4	0		0	GND	0.7		0.9	GND	
Q 5	0		0	0	1.6		2.2	0.9	
Q 6	4.2		4.8	5.0	0		4.9	5.0	
Q 7	0		0.7	GND	0		0.3	GND	
Q 8	0.7		0	GND	0.3		4.1	GND	
Q 9	4.6		0	5.6	4.2		4.9	5.0	
Q10	0		8.2	0	4.9		8.4	4.4	
Q11	7.8		0	8.4	7.8		5.6	8.4	
Q12	4.8		7.9	4.2	0		8.4	0	
Q13	0		0.5	0	3.7		1.5/0	2.8/3.4	IC-2E/A
Q14	0.6		0	GND	0.6/0		0/8.2	GND	IC-2E/A
Q15	0		7.8	0	0/8.2		7.8	0/7.6	IC-2E/A
Q16	7.8		0	8.4	7.8		7.6/0	8.4	

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q17	0.6		8.4	2.0	5.0		8.4	2.0	
Q18	8.2		5.0	8.4	8.4		5.0	8.4	
Q19	0.6		8.2	GND	0.5		8.4	GND	
Q20	0.6		0.6	GND	0.6		0.5	GND	
Q21	5.7		3.4	5.0	5.8		0	5.0	
Q22	3.4		4.0	4.2	0		0	0	
Q23	4.8		3.8	3.9	3.2		1.3	5.0	
Q24	0.6		0	GND	0		4.9	GND	
Q25	2.4		4.2	2.0	0		0	0	
Q26	2.6		3.6	2.0	0		0	0	
Q27	3.6		2.6	4.1	0		0	0	
Q28	0.6		2.0	GND	0		0	GND	
Q29	2.1		4.2	1.9	0		0	0	
Q30	0/4.9		4.4/7.7	2.6/4.9	0/0		0/7.8	0/0	IC-2E/A
Q31	4.4/8.3		8.4/6.1	4.0/8.4	0/8.4		8.4/0	0/8.4	IC-2E/A
Q32	0		0.6	GND	0		0.6	GND	IC-2AT only



## PLL UNIT TRANSISTORS

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q 1	0		4.0	0.8	0		4.0	0.75	
Q 2	0.7		1.0	GND	0.7		1.0	GND	
Q 3	1.6		2.9	1.0	1.6		2.9	1.0	
Q 4	0.7		0.7	GND	0.7		0.7	GND	
Q 5	1.4		3.4	0.9	1.4		3.4	0.9	
Q 6	1.3		4.9	0.8	1.3		4.9	0.8	
Q 7	0		0	1.5	2.0		4.4	1.7	
Q 8	0.5		1.5	GND	0.5		1.7	GND	
Q 9	1.8		4.4	1.5	0		0	1.7	
Q10	0		1.2	GND	0.7		0	GND	
Q11	1.1		8.2	0.5	0		9.0	0	
Q12	0.55		8.6	0.1	0		9.0	0	Power HIGH
Q13	1.2		8.8	GND	0		9.0	GND	
Q14	4.6		0	5.0	4.6		0	5.0	

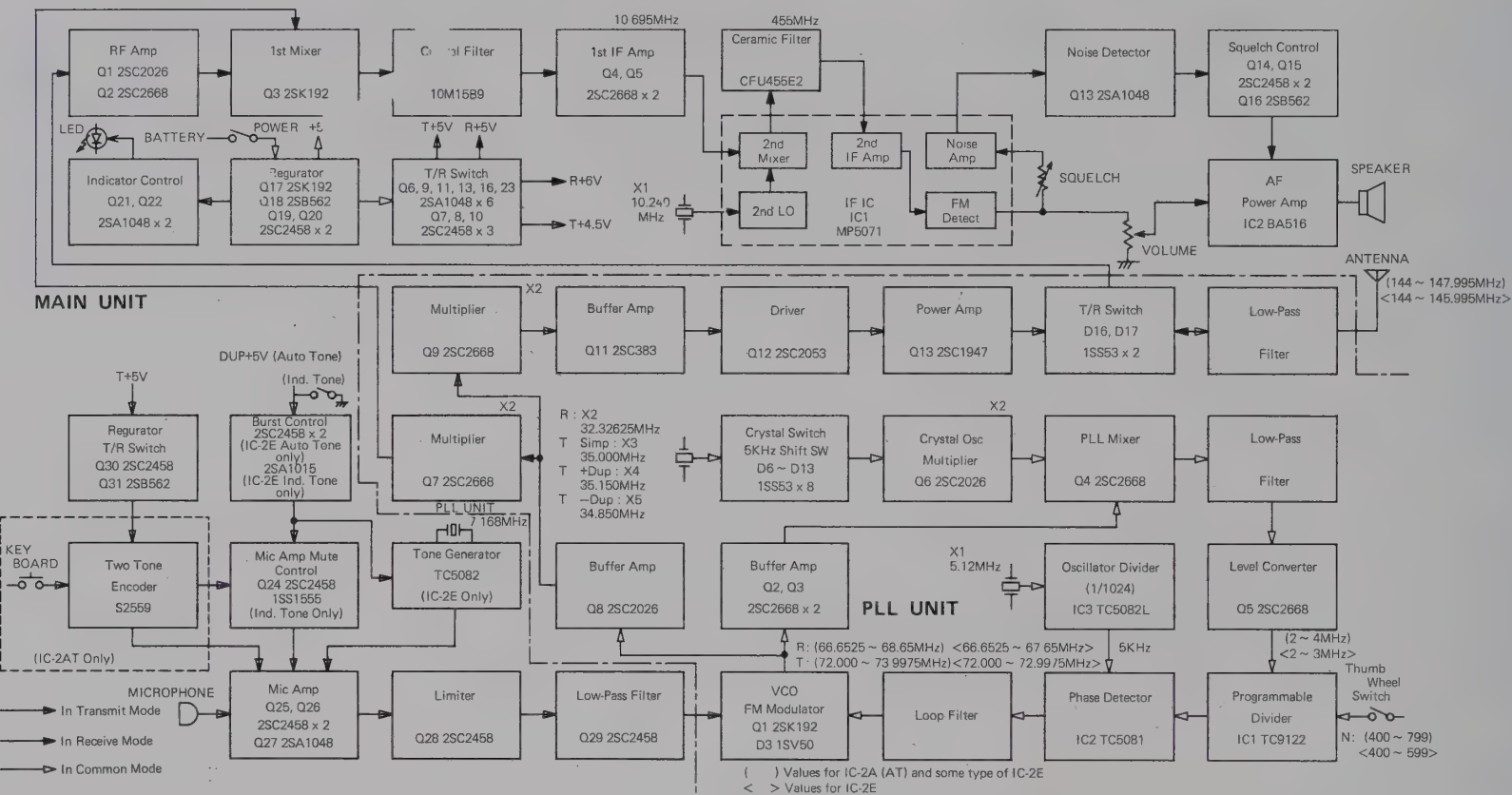
## IN TRANSMIT MODE

UNIT	IC No.	PIN No.																		REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MAIN	IC1	0	0	0	0	0	0	0	0	0	0	0	GND	0	0	0	0			
MAIN	IC2	0	0	0	0	GND	0	0	0	0										
MAIN	IC3	0.8	1.4	1.6	1.8	4.0	2.0	2.0	2.0	GND										IC-2E only
PLL	IC1	5.0	1.6	0	0	0	0	0	0	0	0	4.4	0	4.4	0	0	0	0	GND	f=145MHz
PLL	IC2	0	4.4	1.2	5.0	5.0	0	0	2.4	GND										
PLL	IC3	0.9	1.4	1.8	0	5.0	0	2.4	2.4	GND										
TOUCH TONE	IC1	6.1	5.7	6.1	6.1	6.1	GND	0	6.1	6.1	0	0	0	0	0	4.4	0			IC-2AT only

## IN RECEIVE MODE

UNIT	IC No.	PIN No.																		REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MAIN	IC1	4.2	5.0	5.3	5.6	0.9	0.9	1.1	5.6	2.9	2.0	2.1	GND	5.1	0		2.0			
MAIN	IC2	6.1	4.3	7.6	3.6	GND	3.6	3.6	3.4	3.4										SQL OPEN
MAIN	IC3	0	0	0	0	0	0	0	0	GND										IC-2E only
PLL	IC1	5.6	1.6	0	0	0	0	0	0	0	0	4.4	0	4.4	0	0	0	0	GND	f=145MHz
PLL	IC2	0	4.4	1.2	5.0	5.0	0	0	2.4	GND										
PLL	IC3	0.9	1.4	1.8	0	5.0	0	2.4	2.4	GND										
TOUCH TONE	IC1	0	0	0	0	0	GND	0	0	0	0	0	0	0	0	0	0			IC-2AT only

## SECTION X BLOCK DIAGRAM





## SECTION XI OPTIONS

We have prepared a variety of options for the transceiver IC-2A/AT/E in order to enlarge its use.

**1. BC-30 Nickel-Cadmium Battery Charger**

A convenient set-in type charger for Nickel-Cadmium power packs. Two charging rates provided - high speed and regular rate. The charger is compatible with any type of Nickel-Cadmium power packs.

**2. IC-BP2 Nickel-Cadmium Power Pack**

This power pack has six AA type 450mAH Nickel-Cadmium batteries and provides 1W output power for the IC-2A/AT/E with attendant longer use capability. Recharge time, when using the BC-30 is 1-1/2 hours.

**3. IC-BP4 Battery Case**

This case will accept dry batteries, zinc or alkaline, for 1.5W output, or Nickel-Cadmium for 1W output power. It holds six cells. When Nickel-Cadmium are installed the BC-30 can be used to recharge the batteries.

**4. IC-BP5 Nickel-Cadmium Power Pack**

This power pack has nine AA type 450mAH Nickel-Cadmium batteries and provides 2.3W output power, plus longer operating capability. It can be recharged by the BC-30 in 1-1/2 hours.

**5. IC-CP1 Cigarette Lighter Recharger for IC-BP3**

A handy way to recharge the Nickel-Cadmium packs while mobile - plugs in the cigarette lighter.

**6. IC-HM9 Speaker/Microphone**

A handy speaker and microphone in one unit. Clips on the clothing and operates as both speaker and microphone when plugged in the unit.

**7. Leatherette Case, LC-1/LC-2/LC-3/LC-5/LC-6/LC-7**

A soft leatherette case designed specifically for the IC-2A/AT/E as a convenient, protective case when the set is used outdoors.



**ICOM**

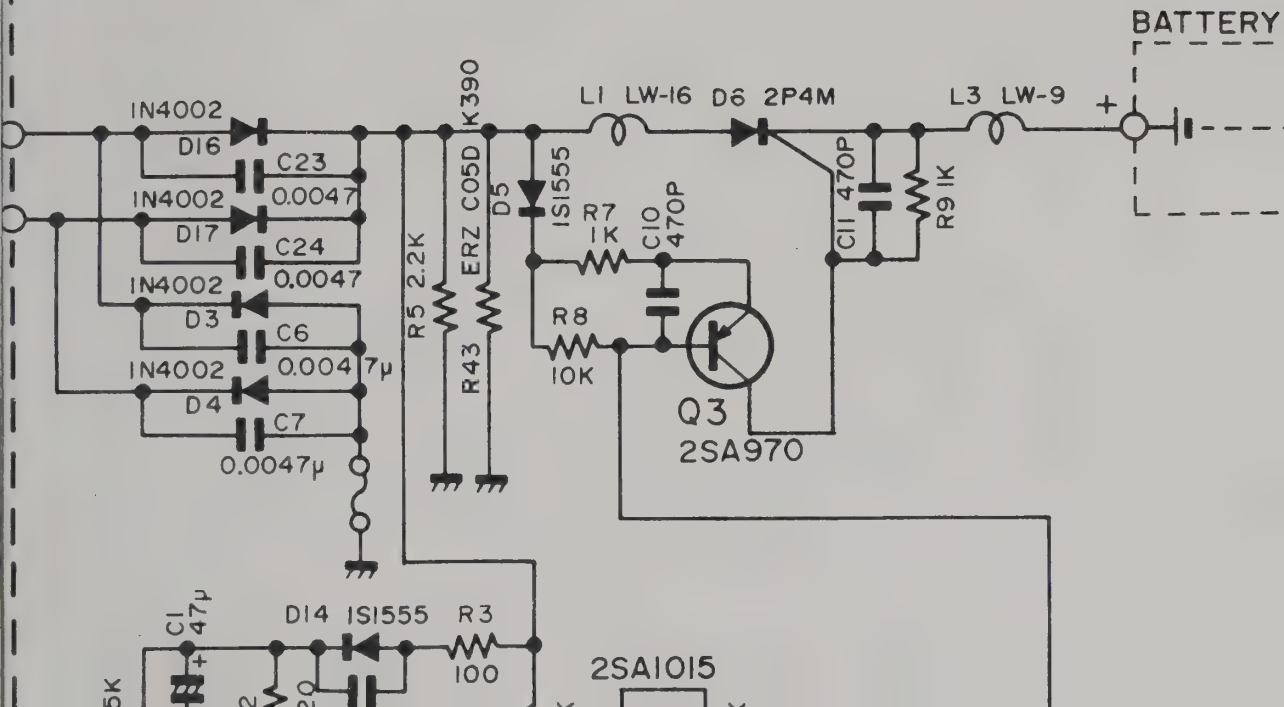
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OSAKA JAPAN

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A-0267B

# BC-35

## SCHEMATIC DIAGRAM







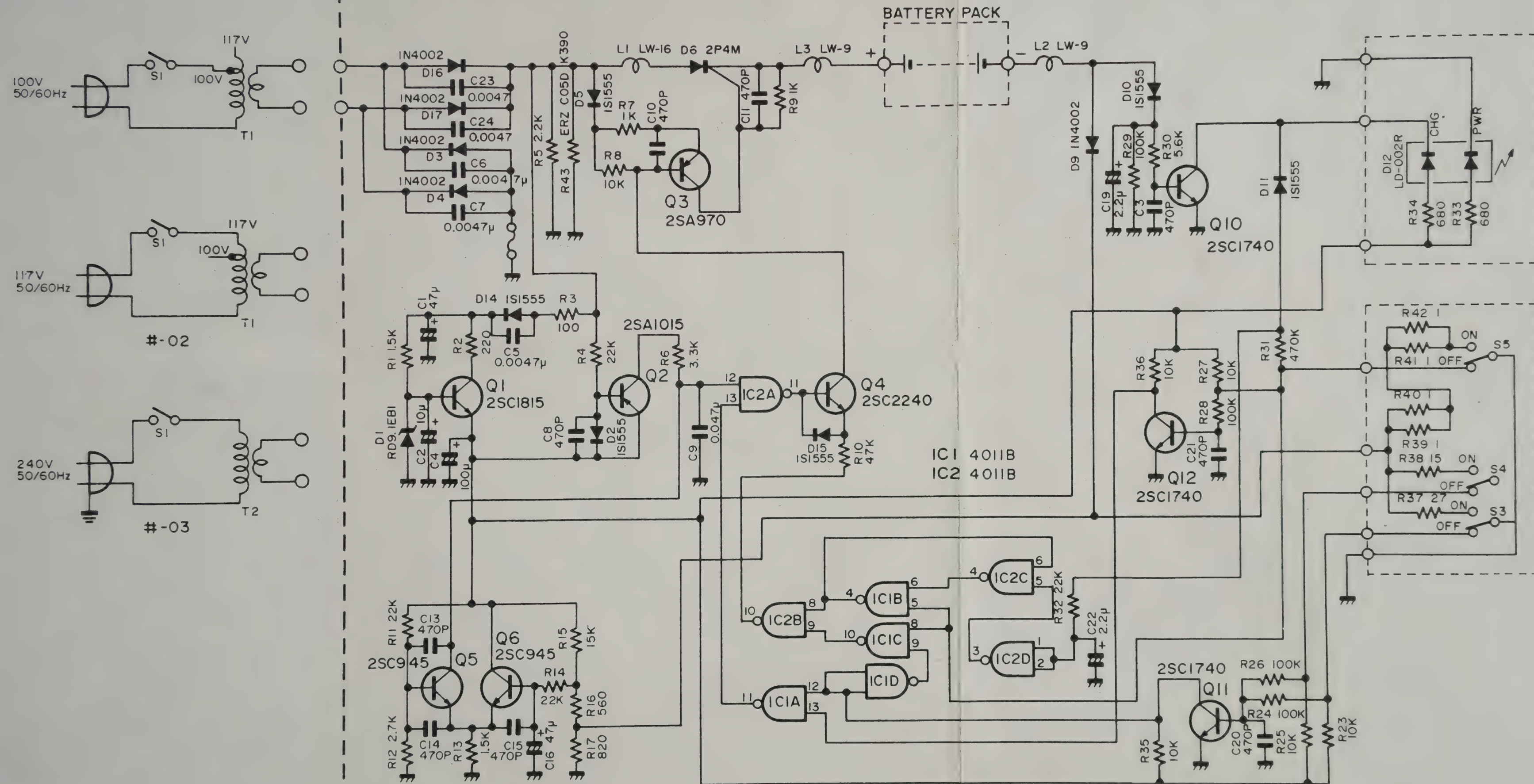
# **ICOM INCORPORATED**

**1-6-19, KAMI KURATSUKURI, HIRANO-KU,  
OSAKA JAPAN**

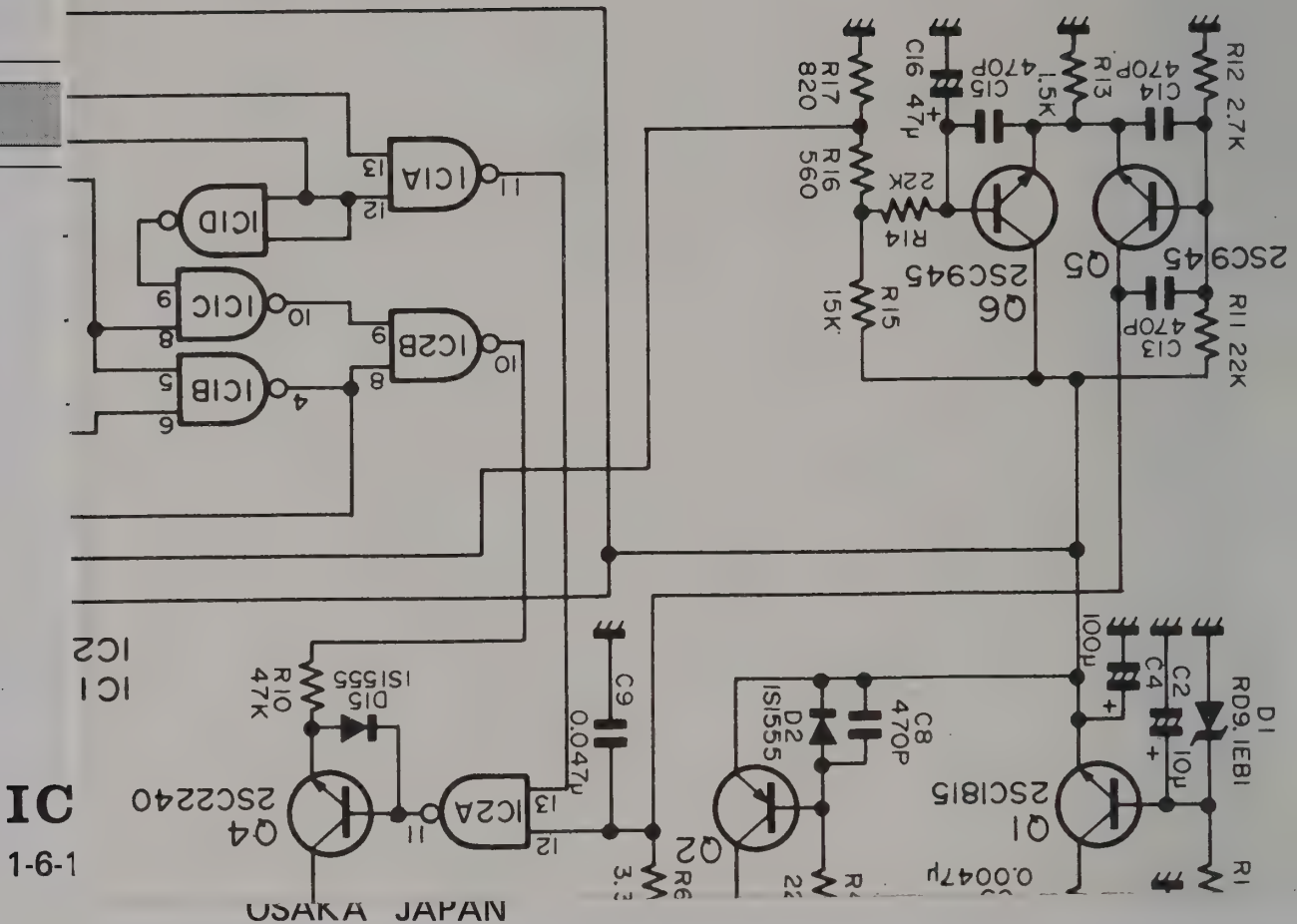
**Printed in Japan  
A-0267B**

# BC-35

## SCHEMATIC DIAGRAM



# ICOM





# ICOM INSTRUCTIONS

## BATTERY PACKS AND CASE

BP-2 BP-3 BP-4  
BP-5 BP-5A BP-7  
BP-8 BP-70

## INTRODUCTION

A wide variety of optional NiCd rechargeable battery packs is available for ICOM's line of advanced handheld transceivers.

For maximum performance with your transceiver using these battery packs, please read these instructions thoroughly.

## PRE-CAUTIONS

1. **NEVER** throw a battery pack into a fire since internal battery gas could cause an explosion.
2. **NEVER** put the battery pack in water. If the battery pack is wet, be sure to wipe it dry.
3. **NEVER** short the terminals on the top panel of the battery pack. Use the plastic insulator strip provided to prevent this when the battery pack is not attached to the transceiver.
4. **NEVER** replace the battery cells. NiCd battery packs can normally be recharged about 300 times. After this, a new battery pack must be purchased. (The batteries in BP-4

## BATTERY PACK NOTE:

The full charge capacity of NiCd batteries may be reduced if repeatedly charged with only partial discharge periods. This is called the Battery Memory Effect. If the battery capacity seems lower than when new, discharge the battery pack completely through normal use, then charge fully using the proper charger.

## BATTERY CASE INSTRUCTIONS

1. Push and hold the sides of the BP-4 BATTERY CASE and push down on the top



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# ICOM INSTRUCTIONS

BATTERY PACKS AND CASE

BP-2 BP-3 BP-4  
BP-5 BP-5A BP-7  
BP-8 BP-70

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4. **NEVER** replace the battery cells. NiCd battery packs can normally be recharged about 300 times. After this, a new battery pack must be purchased. (The batteries in BP-4 are replaceable.)
5. **NEVER** charge a battery pack from more than one power source.
6. **DO NOT** charge with battery chargers that are not recommended. Use the proper charger for each battery pack.
7. **AVOID** continuous charging after full charging. If excessive charging is repeated, efficiency of the battery pack is reduced.
8. **AVOID** charging for more than the specified periods shown in the table.

## CHARGING OPERATIONS

1. Newly purchased battery packs, or those that have not been recharged for two months or longer, should be fully charged for optimum life and operation.
2. Connect the appropriate charger to the battery pack, or insert the battery pack in a drop-in type charger as shown in Fig. 3.
3. The BATTERY CHARGE INDICATOR lights up while charging unless a drop-in type AC BATTERY CHARGER is used.

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## BATTERY CASE INSTRUCTIONS

1. Push and hold the sides of the BP-4 BATTERY CASE and push down on the top aluminum panel. (Fig. 1)

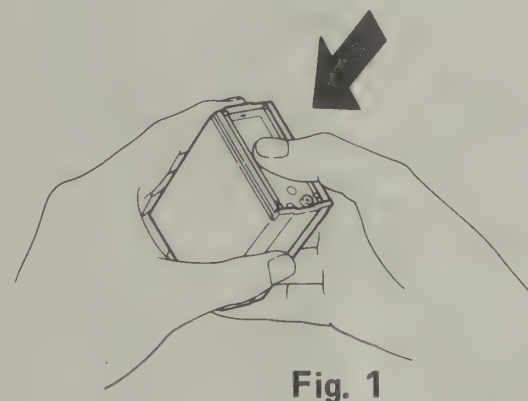


Fig. 1

2. Load the batteries and slide the battery holder into the battery case. (Fig. 2)

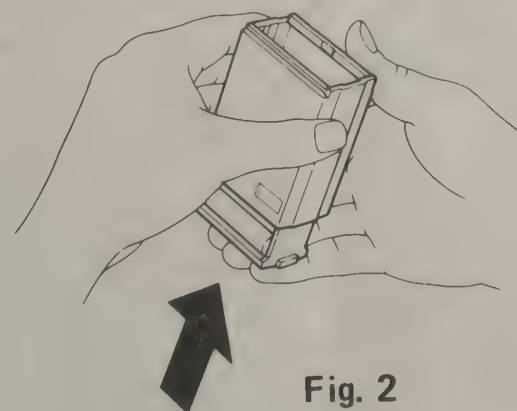


Fig. 2

## CHARGER CONNECTIONS

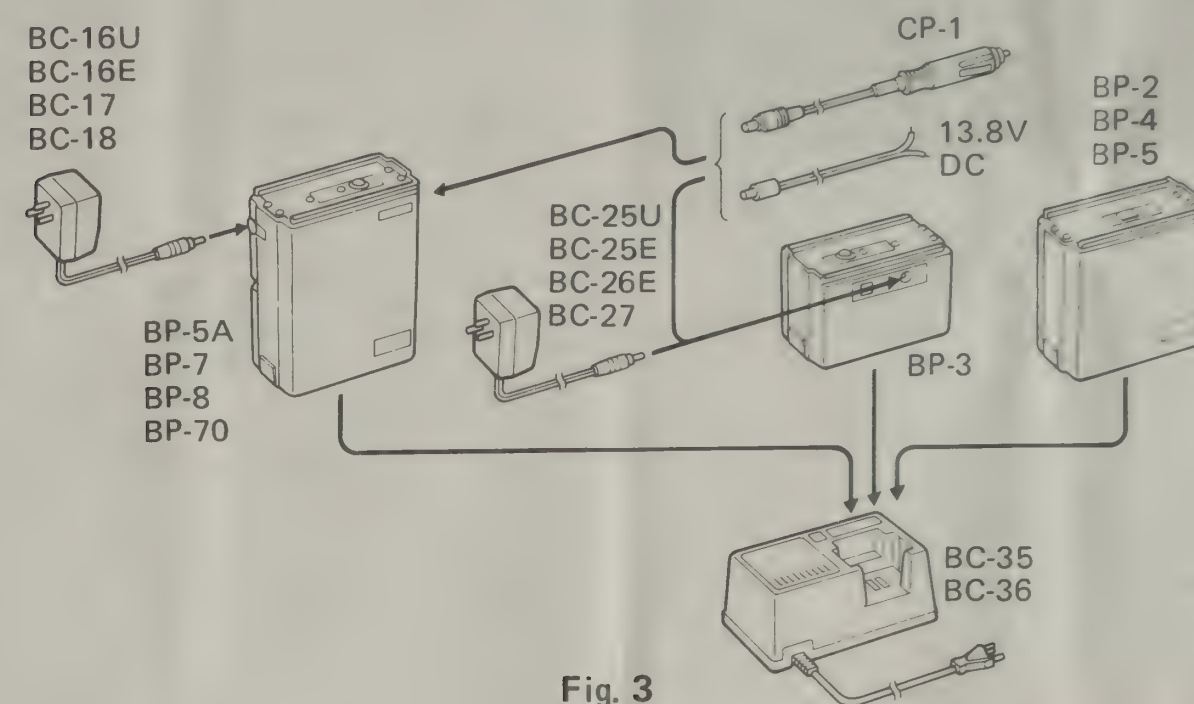


Fig. 3

## SPECIFICATIONS

MODEL	BATTERY CAPACITY	OUTPUT VOLTAGE	CHARGING PERIOD					EXTERNAL DC POWER SOURCE	HEIGHT
			BC-35 BC-36	BC-25U/E BC-26E BC-27	BC-16U/E BC-17 BC-18	CP-1			
BP-2	450mAh	7.2V	1.5hrs.	N/A	N/A	N/A	N/A	N/A	39mm
BP-3	270mAh	8.4V	15hrs.	15hrs.	N/A	15hrs.	15hrs.	15hrs.	39mm
BP-4	AA size x 6	9V or 7.2V	* 15hrs.	N/A	N/A	N/A	N/A	N/A	49mm
BP-5	450mAh	10.8V	1.5hrs.	N/A	N/A	N/A	N/A	N/A	56mm
BP-5A	450mAh	10.8V	1.5hrs.	N/A	15hrs.	15hrs.	15hrs.	15hrs.	80mm
BP-7	450mAh	13.2V	1.5hrs.	N/A	15hrs.	15hrs.	15hrs.	15hrs.	80mm
BP-8	800mAh	8.4V	3hrs.	N/A	15hrs.	15hrs.	15hrs.	15hrs.	80mm
BP-70	270mAh	13.2V	9hrs.	N/A	9hrs.	9hrs.	9hrs.	9hrs.	61mm

N/A: Not Applicable

\* **NEVER** charge zinc or alkaline batteries. Only replaceable NiCd batteries can be charged.

All stated specifications are approximate and subject to change without notice or obligation.

Icom Inc.

6-9-16, Kamihigashi, Hirano-ku, Osaka 547, Japan

Count on us!

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OSAKA JAPAN

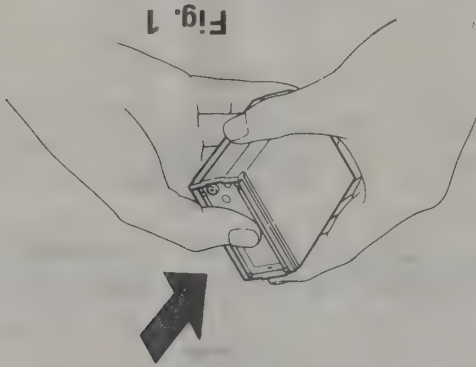


Fig. 1

aluminum panel. (Fig. 1)

2. Load the batteries and slide the battery holder into the battery case. (Fig. 2)

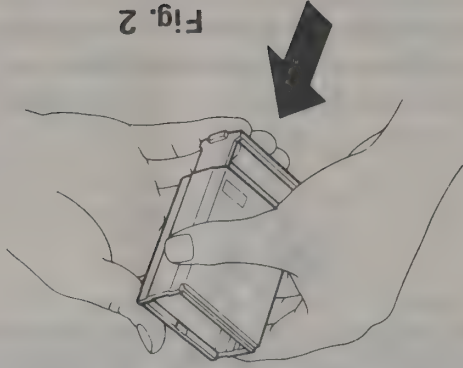


Fig. 2

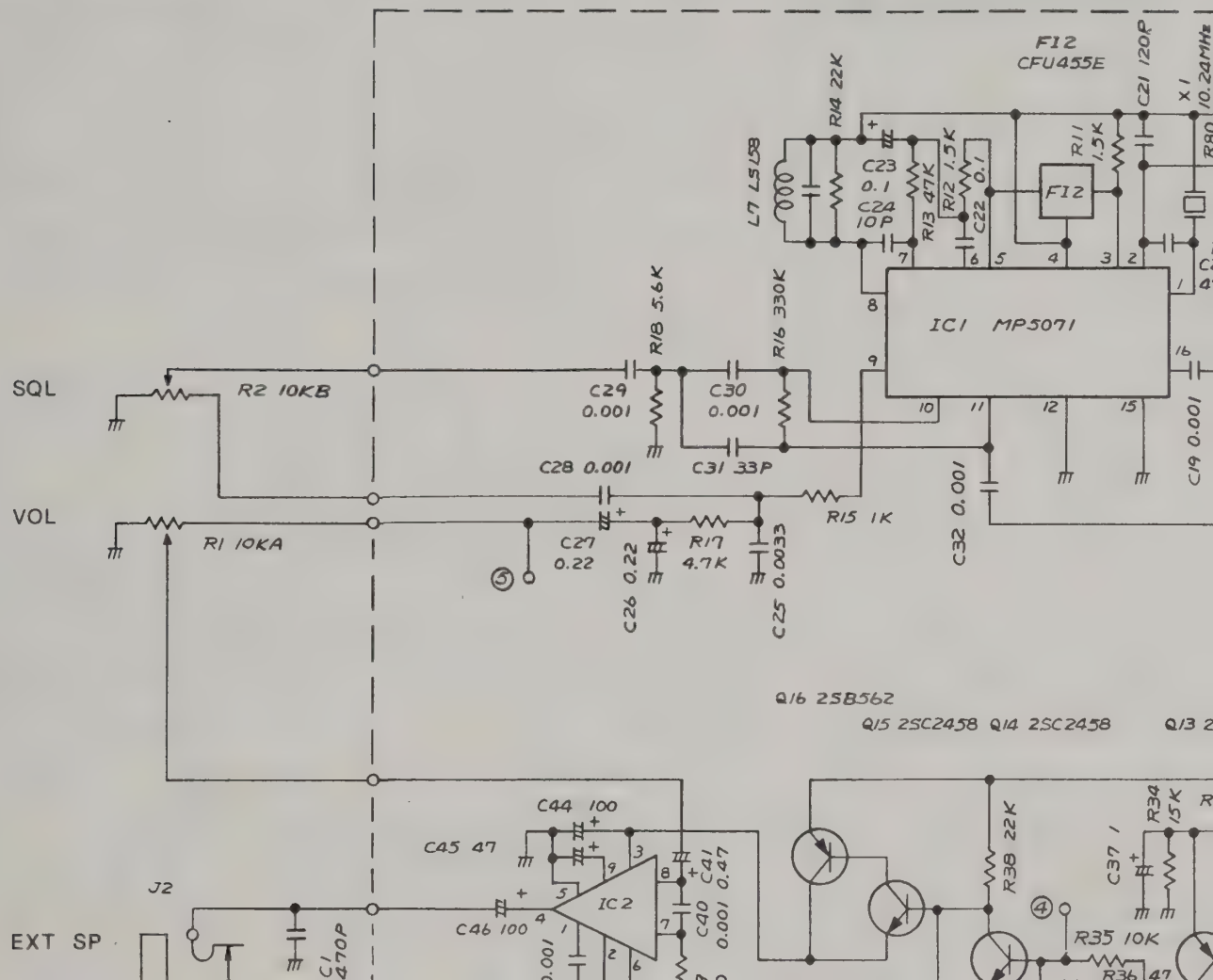
## CHARGING OPERATIONS

5. **NEVER** charge a battery pack from more than one power source.
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# IC-2A/AT/E

## SCHEMATIC DIAGRAM

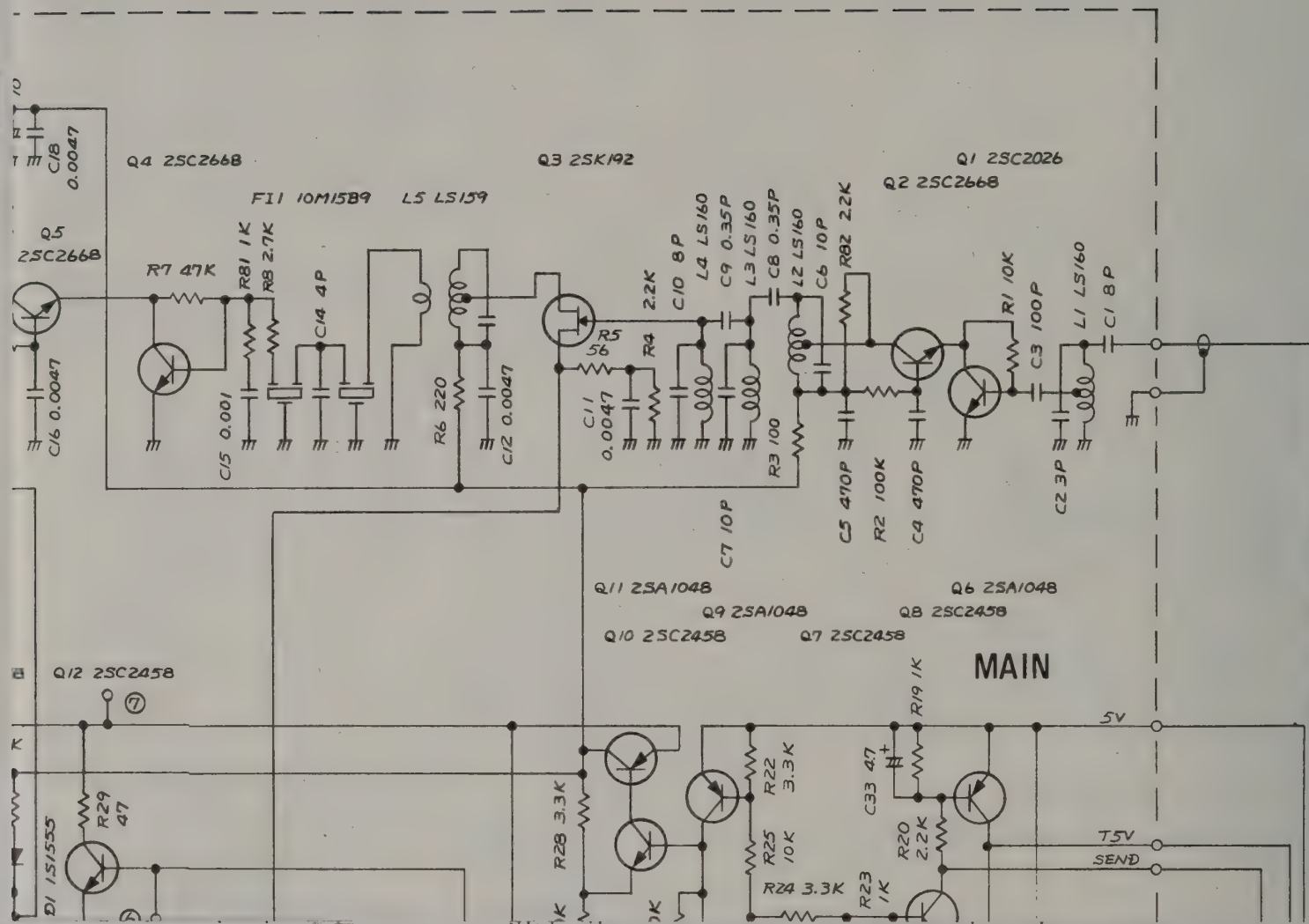


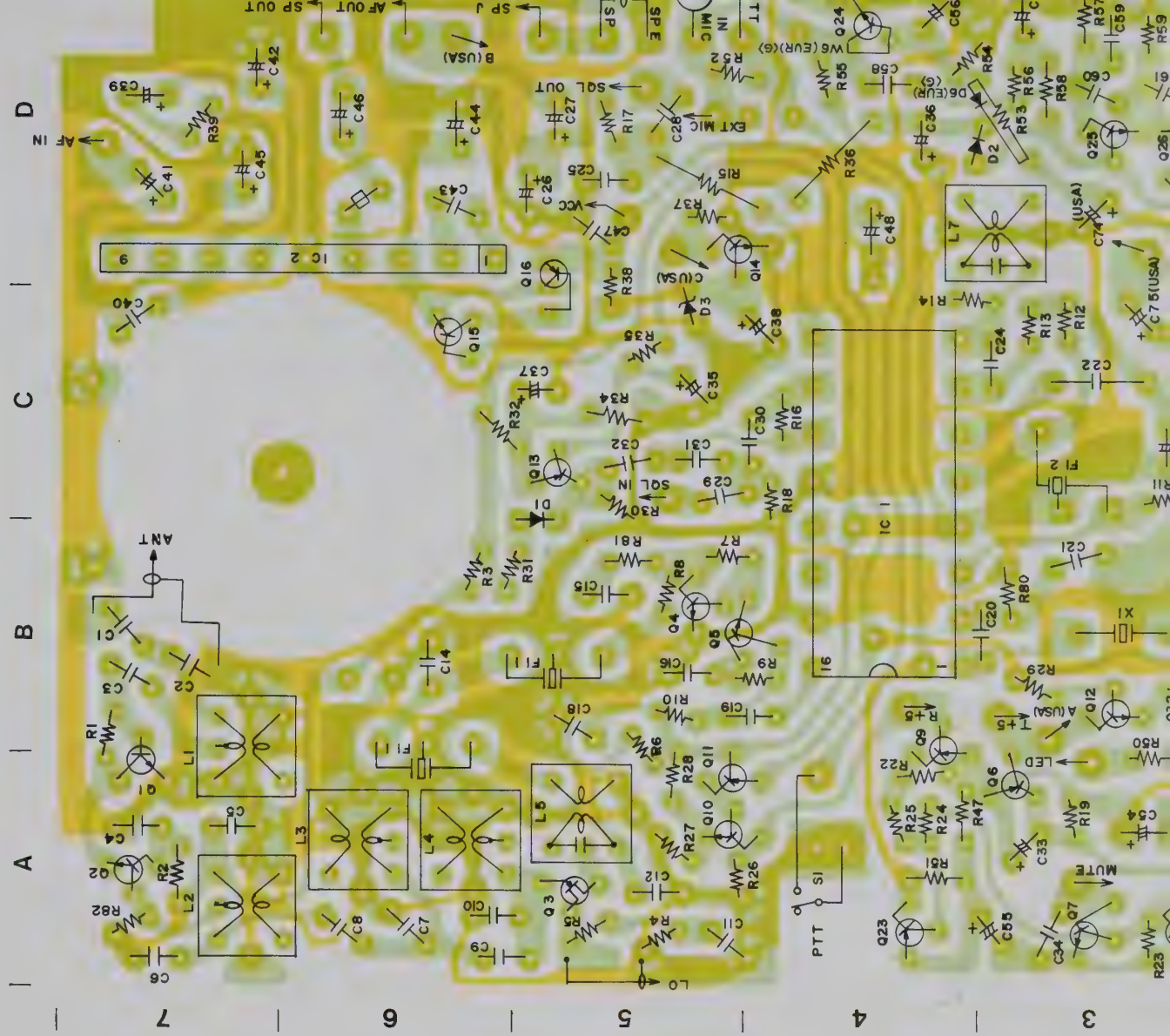




## A-8005-1G-③



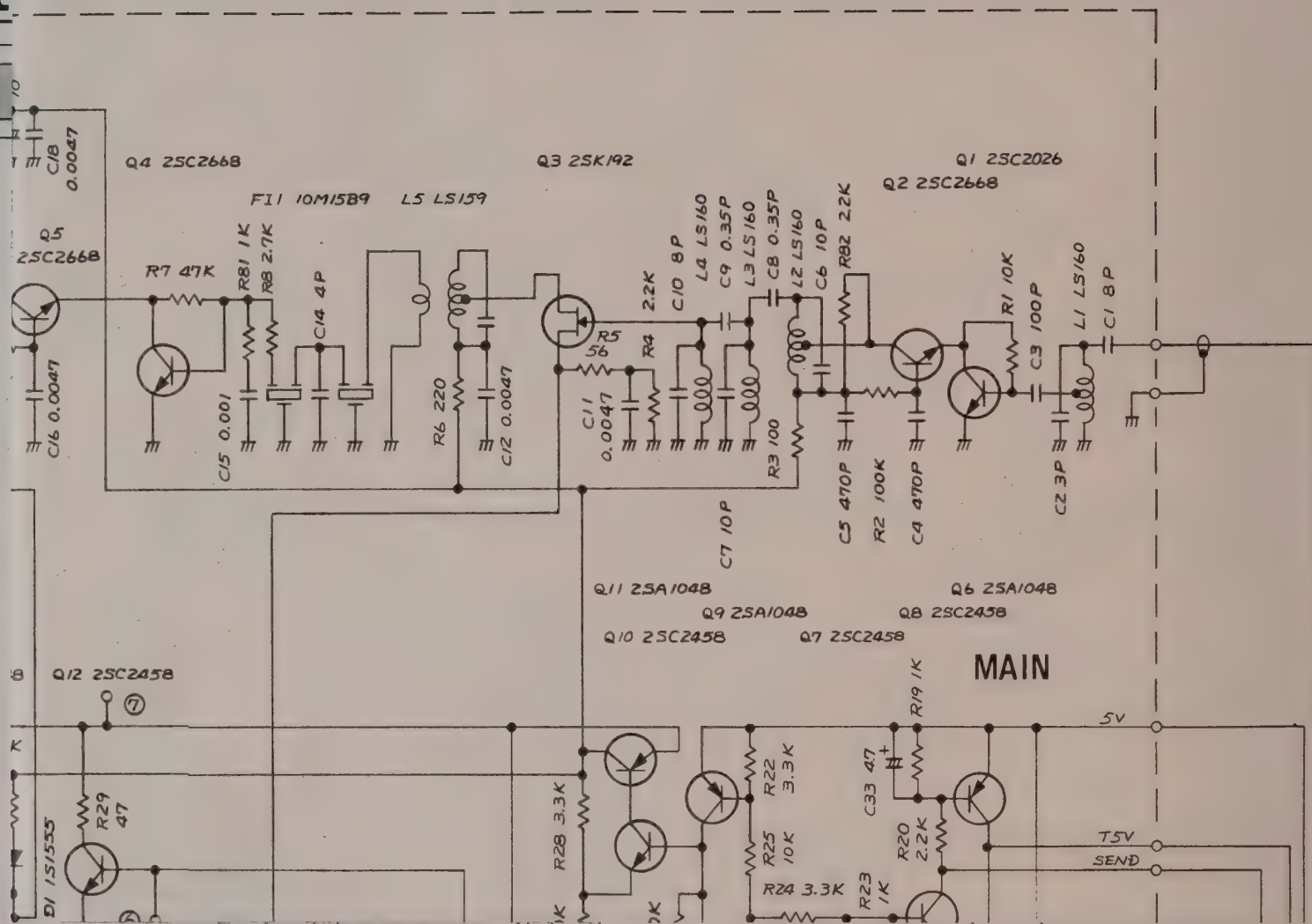




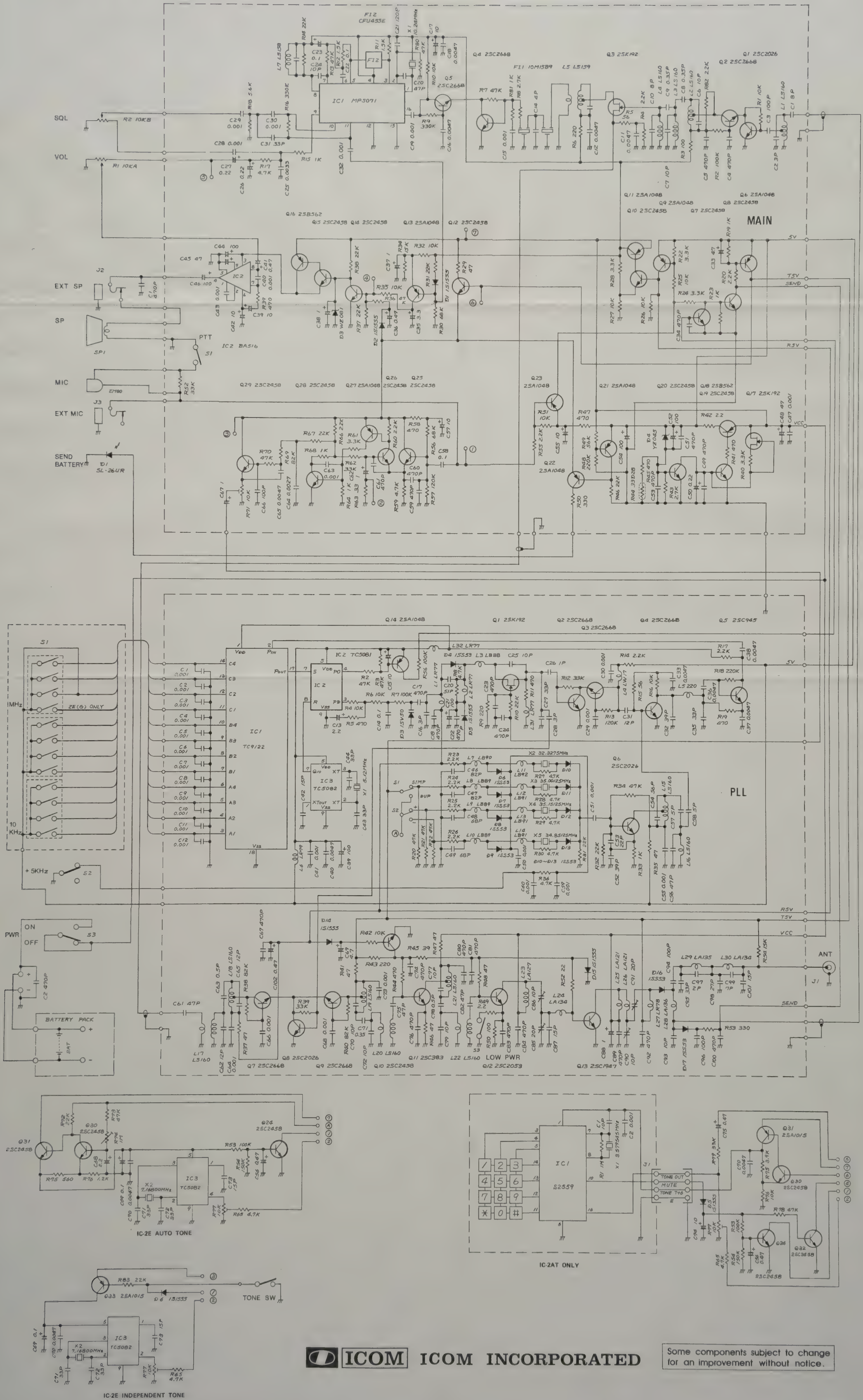




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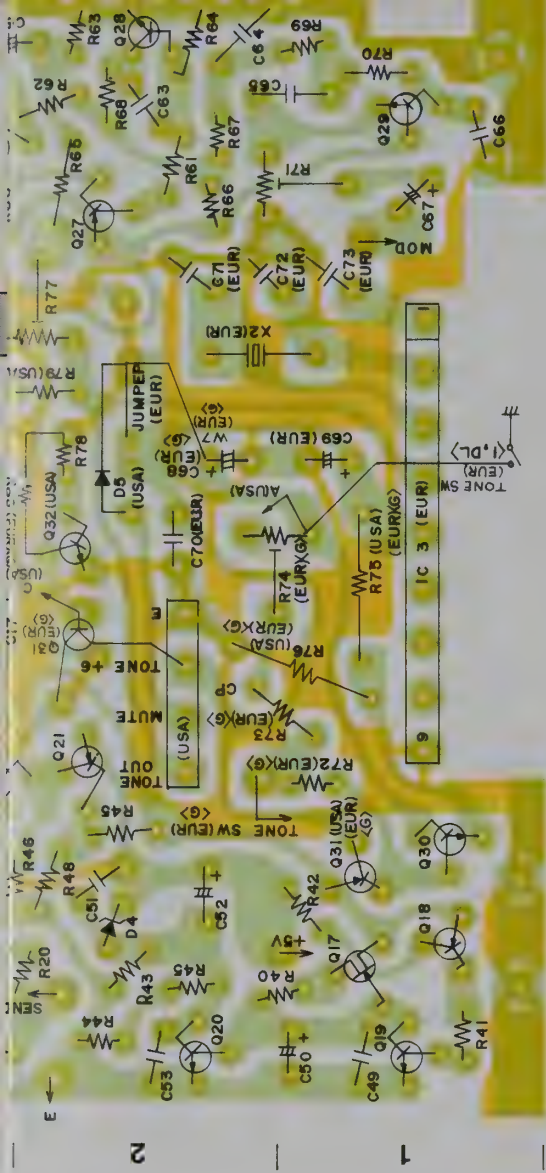
# IC-2A/AT/E SCHEMATIC DIAGRAM



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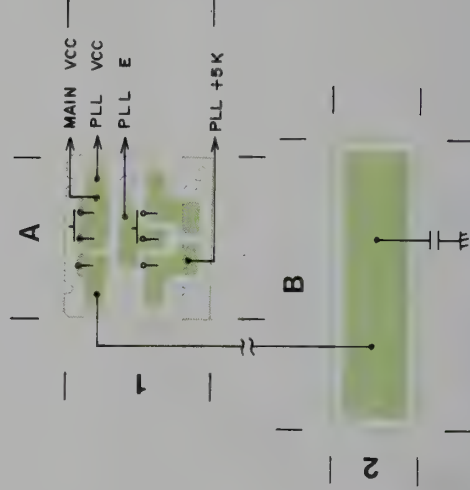




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- (EUR) → EUROPE ONLY
- (EUR) <G> → EUROPE (ENGLAND) ONLY

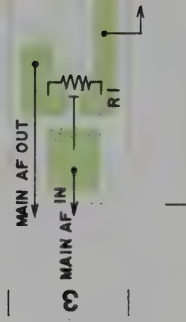
## EF UNIT

### ■ SWITCH BOARD



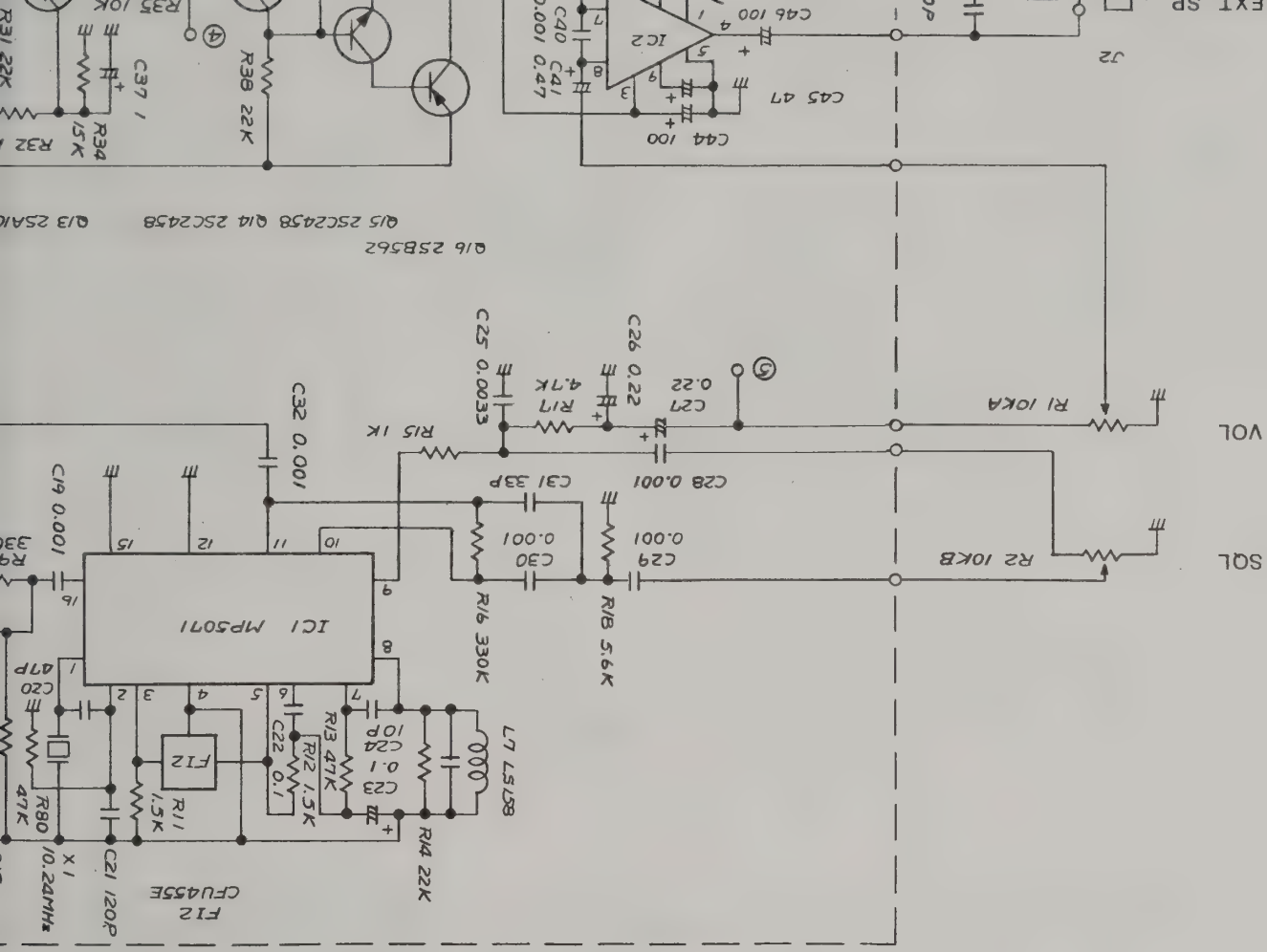
### ■ BATTERY CONTACT BOARD

### ■ VR BOA



# IC-2A/AT/E

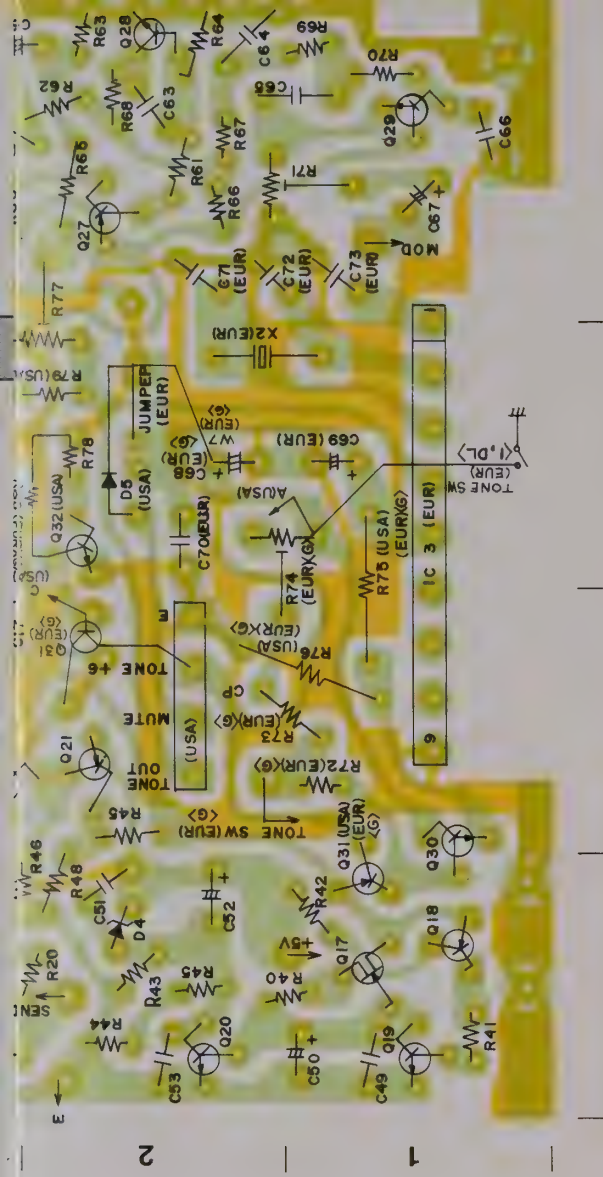
## SCHEMATIC DIAGRAM



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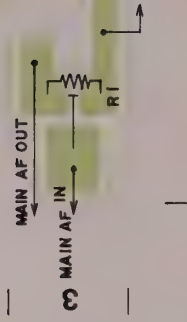
## EF UNIT

### ■ SWITCH BOARD



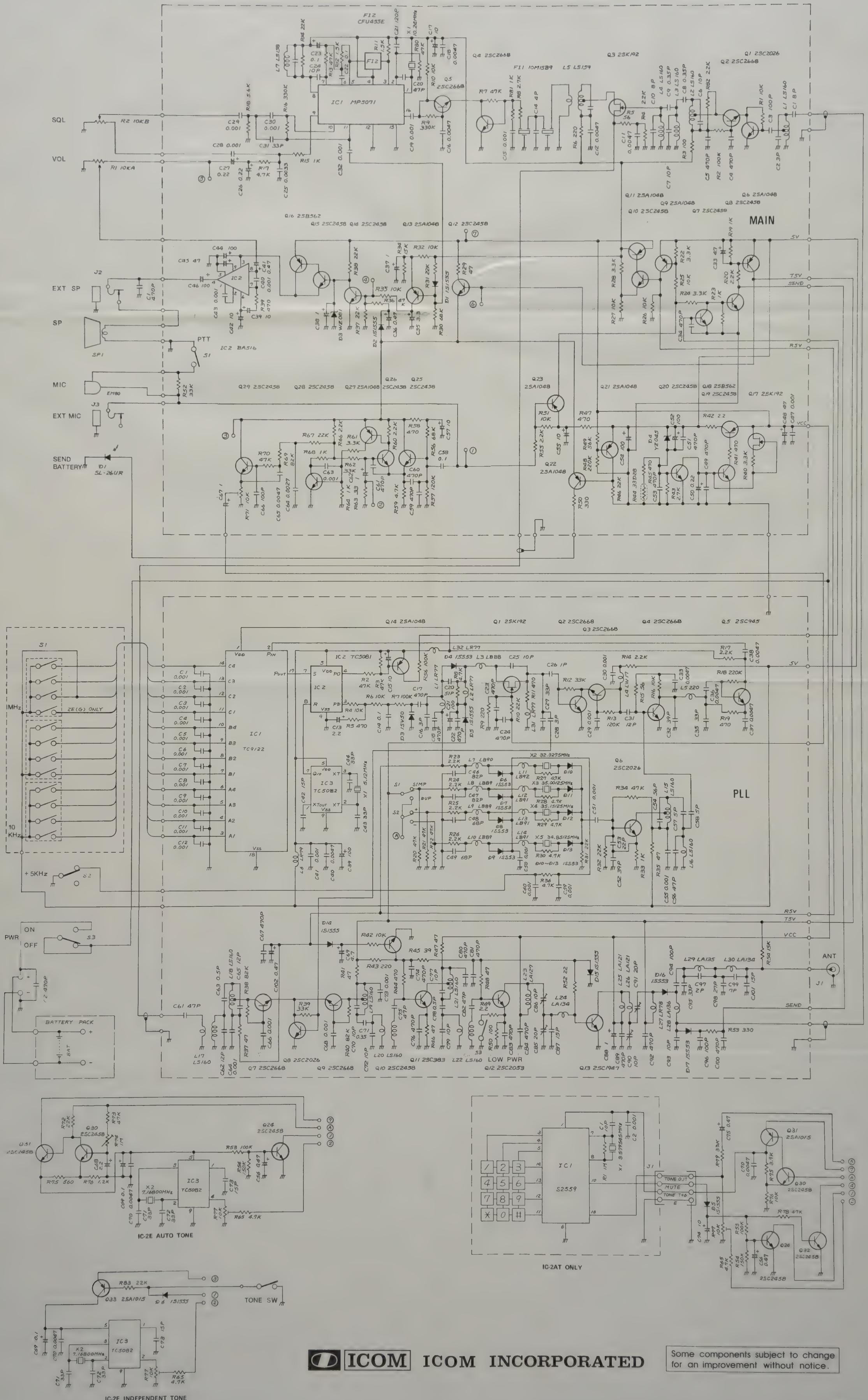
### ■ BATTERY CONTACT BOARD

### ■ VR BOA





IC-2A/AT/E SCHEMATIC DIAGRAM



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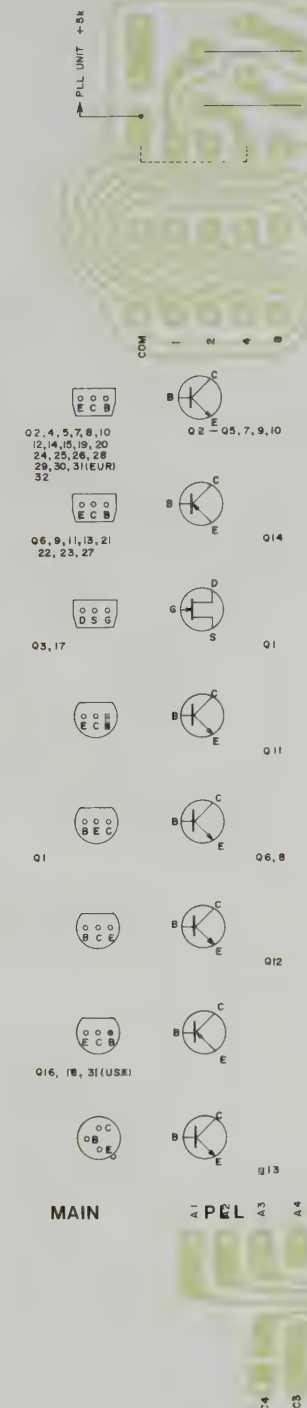
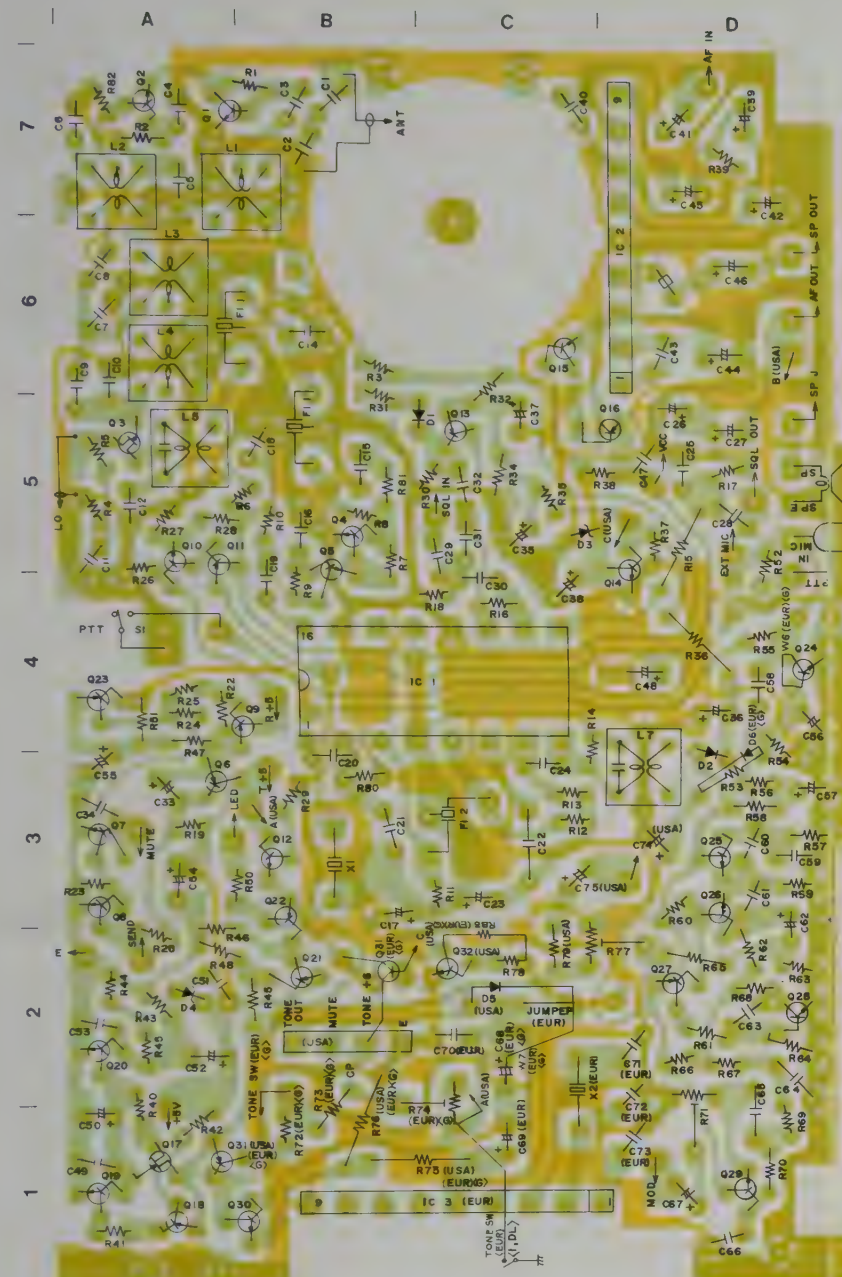


### MAIN UNIT

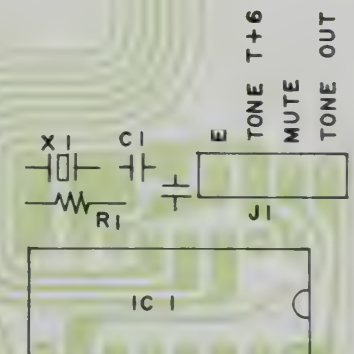
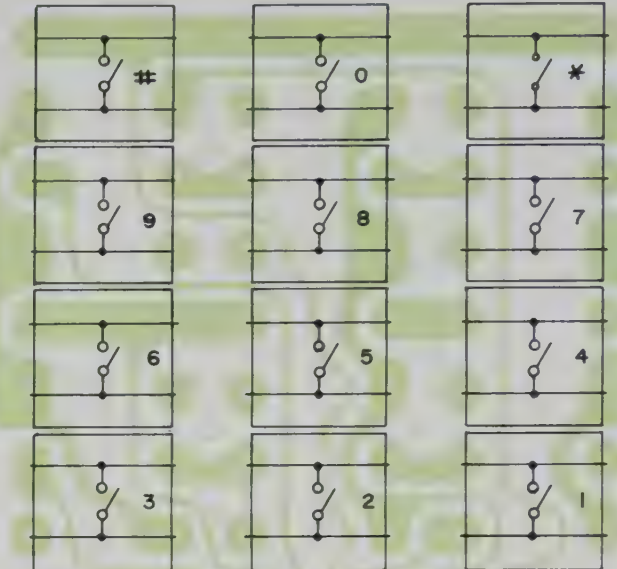
### PLL UNIT

### ■ FLEXIBLE BOARD

### TOUCH TONE UNIT • IC-2AT ONLY



- (USA) → USA ONLY
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- (EUR) <G> → EUROPE (ENGLAND) ONLY



### EF UNIT

#### ■ SWITCH BOARD

#### ■ VR BOARD

### UNIT LAYOUT

EF UNIT  
(SWITCH BOARD)

MAIN UNIT

EF UNIT  
(VR BOARD)

PLL UNIT

PLL UNIT  
(FLEXIBLE BOARD)

EF UNIT  
(BATTERY CONTACT BOARD)



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Printed in Japan







# **IC-2A/AT/E**

144MHz FM TRANSCEIVER

## **INSTRUCTION MANUAL**



## TABLE OF CONTENTS

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XI. OPTIONS .....	29

## **SECTION I INTRODUCTION**

### **SYNTHESIZED HANDIE TALKIE**

Small, light, and 800 channels capability (IC-2E : 400 channels), a handy for use any time, whether outdoors, in a car, or at home, 800 channels for use on any 2 meter frequency, or any repeater.

### **DUAL POWER LEVEL**

Transmitter output can be switched easily to either of two levels; 1.5W output HIGH for long distances, and 0.15W LOW for short distances. Battery consumption is minimized in the Low Power Mode.

### **VARIOUS POWER PACKS AVAILABLE**

The Power Pack is slipped on the bottom of the radio very easily, and various power packs are available to suit your needs, for minimum size, longer use, or higher power.



## SECTION II SPECIFICATIONS

### GENERAL

Number of Semi-conductors	Transistors	43 (42) < 41 >
	FET	3
	IC	5 (6) [6]
	Diodes	21 (20)
Frequency Coverage	144.000 ~ 147.995MHz Some type of IC-2E has this frequency coverage (144.000 ~ 145.995MHz)	
Frequency resolution	5KHz steps 800 (400) channels	
Frequency Control	Digital PLL synthesizer, with thumb wheel switch	
Frequency stability	Within $\pm 1.5$ KHz	
Usable Temperature	$-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$ ( $14^{\circ}\text{F} \sim 140^{\circ}\text{F}$ )	
Antenna impedance	50 ohms unbalanced	
Power supply requirement	DC 8.4V; with attendant battery pack, DC 6 ~ 16V negative ground is acceptable	
Current drain at 8.4V	Transmitting	
	HIGH : 1.5W	Approx. 550mA
	LOW : 0.15W	Approx. 220mA
	Receiving	
	At max audio output	Approx. 130mA
	Squelched	Approx. 20mA
Dimensions	116.5mm (H) x 65mm (W) x 35mm (D) Without battery pack Attendant battery pack, IC-BP3 49mm (H) x 65mm (W) x 35mm (D)	
Weight	470g [490g] including battery pack, IC-BP3 and flexible antenna	

## TRANSMITTER

Output power	HIGH: 1.5W, LOW: 0.15W at 8.4V
Emission mode	16F <sub>3</sub>
Modulation system	Variable reactance frequency modulation
Max. frequency deviation	±5KHz
Spurious emission	More than 60dB below carrier
Microphone	Built-in Electret condenser microphone Optional Speaker-microphone can be used
Operating mode	Simplex Duplex ±600KHz from receive frequency

## RECEIVER

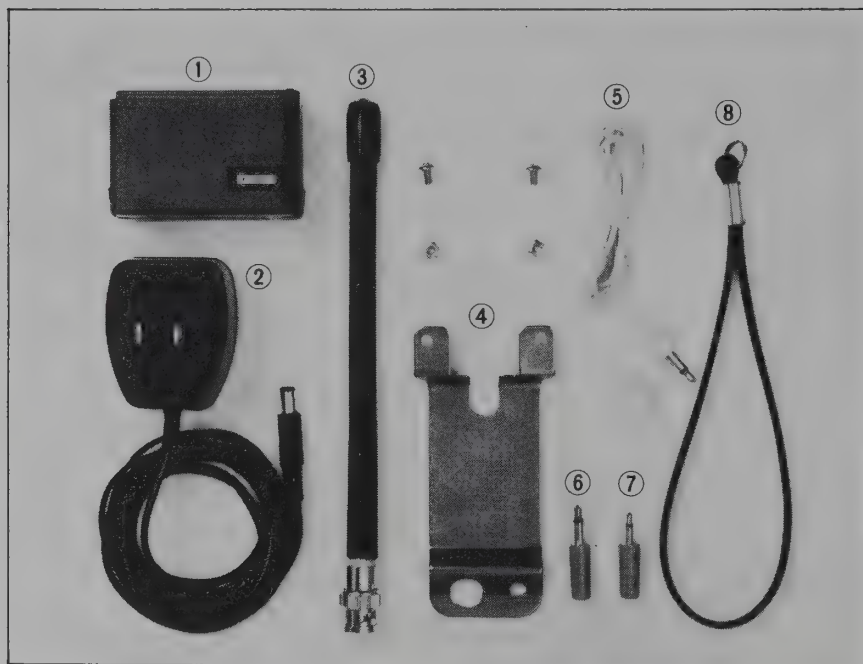
Receiving system	Double-conversion superheterodyne
Modulation acceptance	16F <sub>3</sub>
Intermediate frequency	1st: 10.695MHz 2nd: 455KHz
Sensitivity	More than 26dB S+N+D/N+D at 1μV Less than 0.5μV for 20dB Noise quieting
Squelch sensitivity	Less than 0.4μV
Spurious response rejection ratio	More than 60dB
Selectivity	More than ±7.5KHz at -6dB point Less than ±15KHz at -60dB point
Audio output power	More than 300mW
Audio output impedance	8 ohms

**Note:** ( ) Values for IC-2E Auto Tone type < > Values for IC-2E Independent Tone type.  
[ ] Values for IC-2AT

Specifications are approximate and are subject to change without notice or obligation.

## SECTION III ACCESSORIES

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Various accessories are packed with the transceiver. Make sure you have not overlooked anything.



- |                                   |   |
|-----------------------------------|---|
| 1. Battery pack IC-BP3 . . . . .  | 1 |
| 2. Wall charger BC-25U/E. . . . . | 1 |
| 3. Flexible antenna . . . . .     | 1 |
| 4. Belt clip. . . . .             | 1 |
| 5. Earphone. . . . .              | 1 |
| 6. Earphone plug . . . . .        | 1 |
| 7. Microphone plug. . . . .       | 1 |
| 8. Hand-strap . . . . .           | 1 |

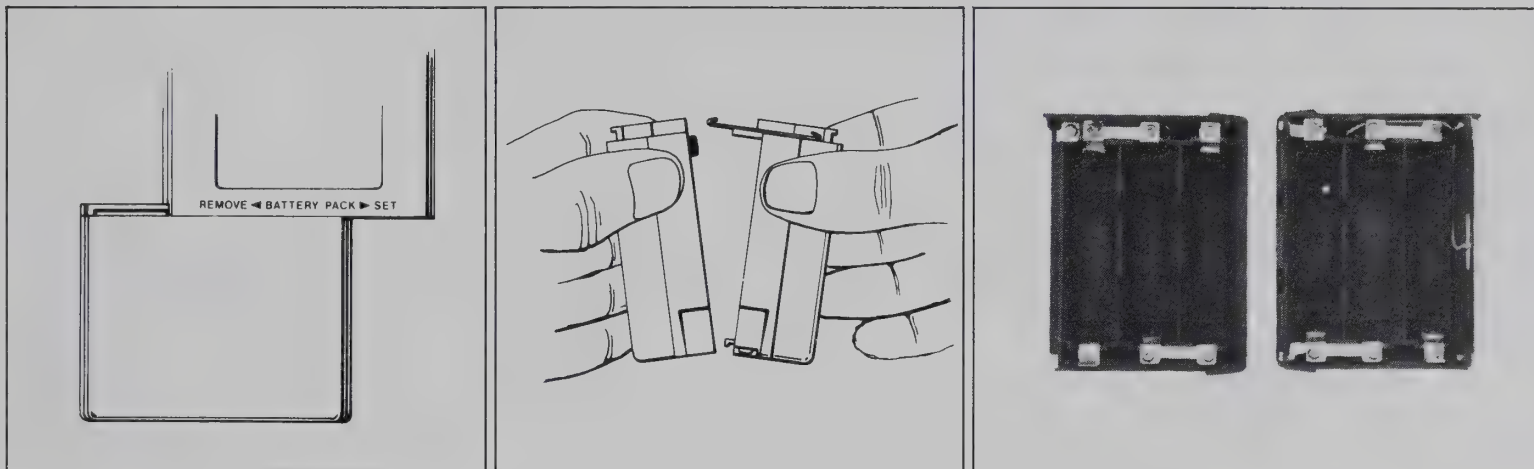


## SECTION IV PRE-OPERATION

### BATTERY INSTALLATION

When using alkaline battery pack IC-BP4:

Place the power switch in the OFF position. Remove the battery pack from bottom of the set by pushing the pack in the indicated direction as follows: Separate the pack into two parts (case) as follows:



Each case holds three AA type batteries. Install batteries into each case, according to indicated polarity. With the batteries properly in place, carefully replace the pack and slip it onto the set with the reverse procedure.

Also, AA type Nickel-Cadmium, rechargeable, batteries can be used. But the charger for them should be the optional BC-30 charger.

## **WHEN TO REPLACE BATTERIES (When using alkaline batteries).**

When the Transmit Indicator LED does not light up during transmission, the batteries are exhausted. Use batteries of the same type, for mixed types might cause leakage. Replace worn batteries with a complete new set. If used with old batteries, the life of new ones might be shortened. Battery life is shortened more by transmitting than by receiving, since several times more current is drawn in transmit. To prolong battery life, therefore, practice as follows:

- \* Try to minimize the transmit period.
- \* Reduce volume during reception.
- \* Be sure to cut off power source when set is not used.

More working hours are available if high-performance batteries are employed.

### **When using Nickel-Cadmium battery pack IC-BP3:**

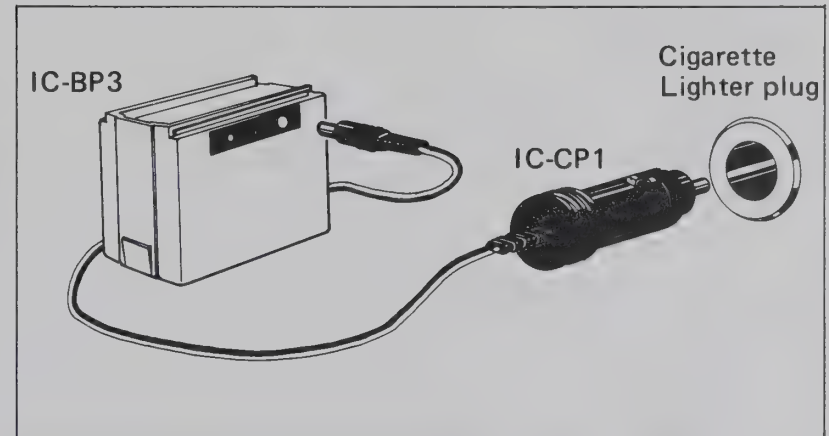
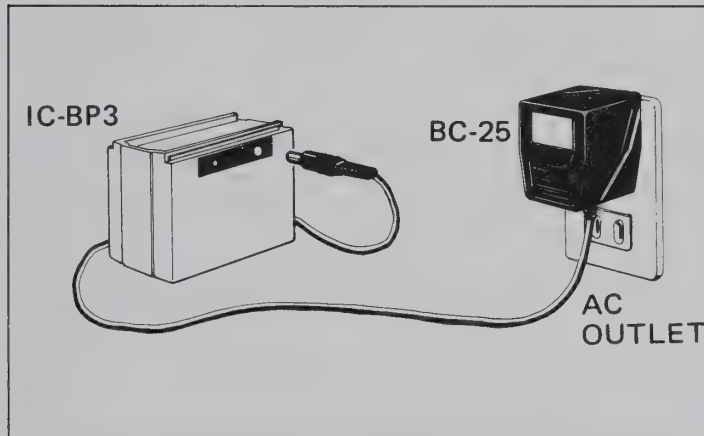
The IC-BP3 is a rechargeable Nickel-Cadmium battery pack, and it can be slipped onto or off of the set very easily. It has a connector for a charger charge-current control circuit, reverse polarity protection circuit and charge indicator LED in it's own pack. You can use the supplied BC-25U/E wall charger or similar simple wall charger, or a car battery by using optional cable IC-CP1 for recharging. Before use, the battery pack should be charged about 15 hours, because the battery may have discharged. (Refer "How to charge" on page 7.)

After charging is completed, the batteries can be used in the same manner as dry cells. However, the voltage of Nickel-Cadmium batteries drops rapidly just before they are exhausted, so when the Transmit Indicator LED of the transceiver goes out, be sure to immediately stop using it, and charge the batteries again.

## HOW TO CHARGE (When using Nickel-Cadmium battery pack IC-BP3).

1. Use the supplied wall charger BC-25U/E or a stable power source with an output voltage of DC 13.8V and current capacity over 50mA, or use a 12V car battery with optional charger cable IC-CP1. (Output voltage of 12~15V can be used, but output voltage near the specified voltage should be used.)
2. The power switch of the transceiver must be OFF, or remove the battery pack from the transceiver.
3. Connect the output plug of the wall charger (BC-25U/E), or other power source, to the charger socket of the battery pack. (When charging Nickel-Cadmium batteries in the IC-BP4 battery pack, you should use the BC-30 charger only.)

The charge indicator LED of the battery pack is lit, which shows that the charger is working.





4. It takes about 15 hours to charge the batteries completely. This charger is designed for 0.1°C (10-hour rate current), but charge for 15 hours in order to compensate for any unbalance of the batteries.

You should charge the batteries for 15 hours when you have not used them for a long time or after buying them.

5. Charge between 0°C and 40°C.
6. Avoid continuing charging as much as possible after full charging, (15 hours). If excess charging is repeated, efficiency of the battery pack is reduced.
7. After charging, unplug the plug of the power source from the charger socket of the battery pack. The transceiver and the battery pack is now ready for operation.

## **PRECAUTIONS FOR USE OF THE NICKEL-CADMIUM BATTERIES**

**(from the JIS C8705 MANUAL)**

### **General Cautions**

1. Never short the battery pack.  
Since internal resistance is low, excess shorted current flows away, causing the batteries or conductors to burn. Avoid shorts!
2. Never solder the batteries directly.  
If the batteries are soldered directly, the separator or insulator may be melted and damaged. Accordingly, the terminal must be spot-welded first and then soldered.
3. Confirm polarities in order to prevent reverse charging. If they are charged in reverse, batteries may be damaged. Therefore confirmation of correct polarity is essential.
4. Never charge with excess charging current.  
If an excess charging rate is employed, gas consumption speed cannot keep up with gas generating speed at the time of charging. Batteries may be damaged by increasing internal pressure. Accordingly, the charging must be kept regulated.

5. Avoid charging under 0°C or over 40°C.

Under 0°C, since gas consumption speed becomes lower at the charging time, inside pressure increases and hydrogen is generated. Since charging efficiency is reduced over 40°C, it is rather difficult to charge. Accordingly, charging must be done between 0°C and 40°C.

6. Never put batteries into fire.

Since there may be a little gas left in the batteries, internal pressure increases suddenly and the batteries explode if thrown into a fire. Also, battery electrolyte is ejected and can cause damage to skin and clothes.

## **FOR OUTDOOR USE**

1. Attach the supplied battery pack. (Refer to "BATTERY INSTALLATION")
2. Attach the supplied hand strap and belt clip through the fixture on the body (as shown in the drawings on page 10).
3. Attach the flexible rubber antenna.

## **FOR USE IN THE CAR**

1. Avoid using the unit near the outlet of heaters, air-conditioners, etc.
2. Put the unit in a convenient place to avoid disrupting safe driving.
3. Firmly ground to the car body a mobile antenna (e.g. whip antenna) that requires it.

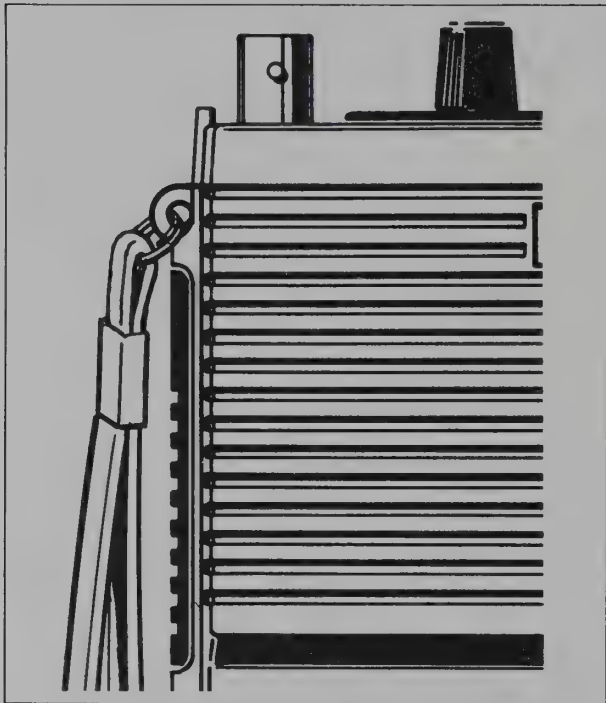
## **FOR FIXED USE**

1. Avoid putting the unit in places exposed to rain, water splash, direct sunshine, dust, vibration, or heat.
2. An external antenna should be used for indoor operation. The use of the flexible antenna indoors may cause TVI, BCI, Hi-Fi interference, malfunction of stabilized DC power supply.

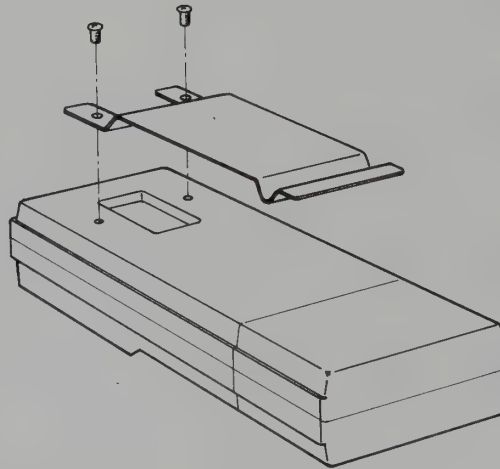
## EXTERNAL ANTENNA

1. Select a high performance antenna (a multi-element beam or gain antenna) and set it up in the highest possible position.
2. Use a 50 ohm antenna and coaxial cable.
3. On VHF, the power loss in the antenna cable is large, so use a cable with the lowest possible loss and make it as short as possible.
4. Use a BNC plug for connection to the unit.

## ATTACHMENT OF HAND STRAP AND BELT CLIP



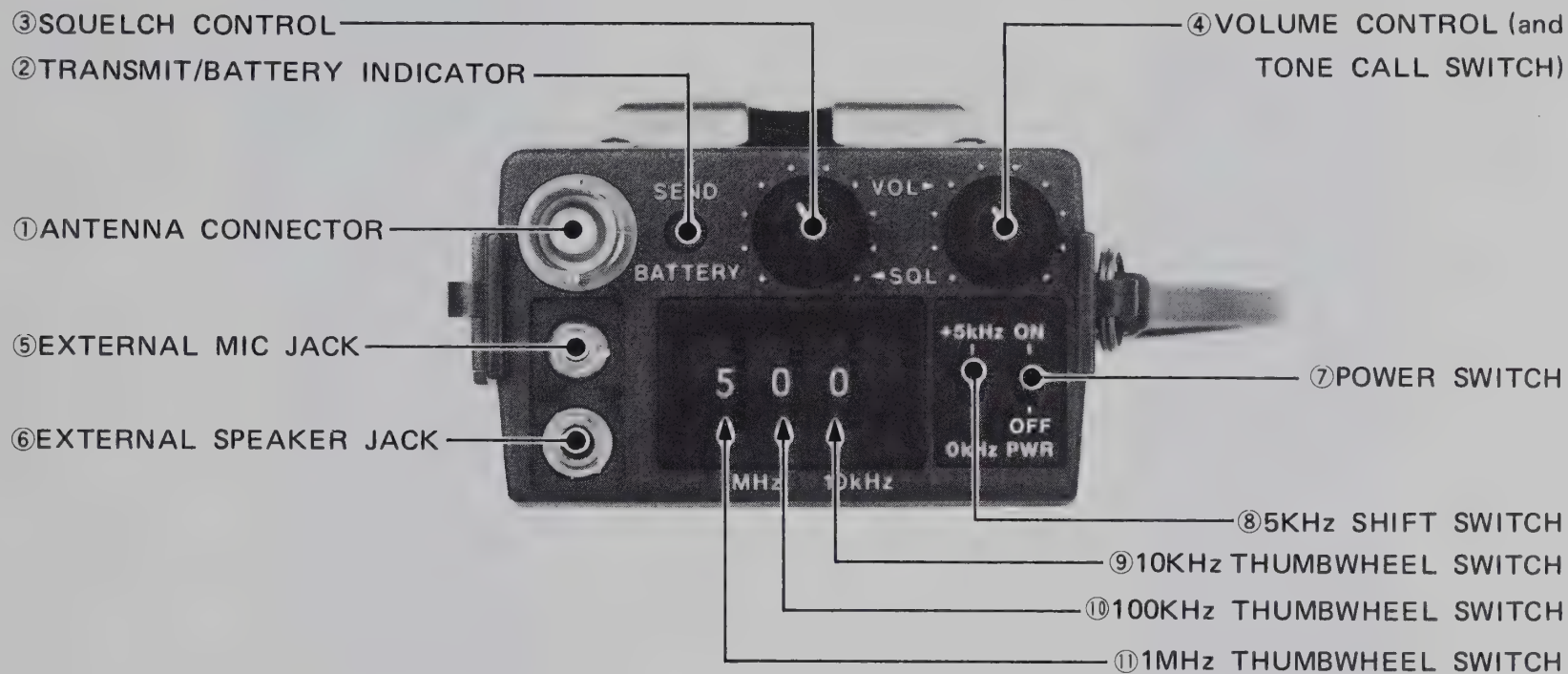
- Attach the belt clip on the back cover with 2 screws supplied.





## SECTION V CONTROL FUNCTIONS

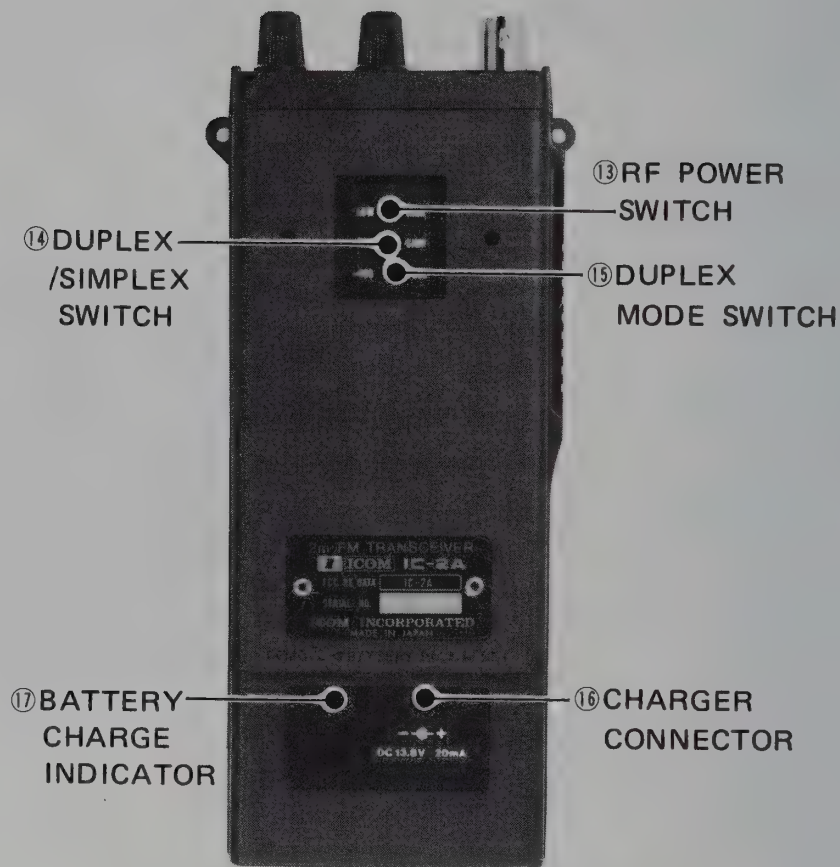
### TOP PANEL



## FRONT PANEL



## REAR PANEL



① **ANTENNA CONNECTOR**

Connect the supplied flexible antenna. An external antenna can be used, using a BNC connector.

② **TRANSMIT/BATTERY INDICATOR**

Illuminates in the transmit mode. Also indicates the battery condition; during transmission. The voltage of Nickel-Cadmium batteries drops rapidly just before they are exhausted, so when this indicator goes out, be sure to immediately stop using it, and charge the batteries again.

③ **SQUELCH CONTROL**

Sets the squelch threshold level. To turn OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

④ **VOLUME CONTROL (and TONE CALL SWITCH)**

Controls the audio output level in the receive mode. Clockwise rotation increases audio output.

**TONE CALL SWITCH (IC-2E independent tone type only)**

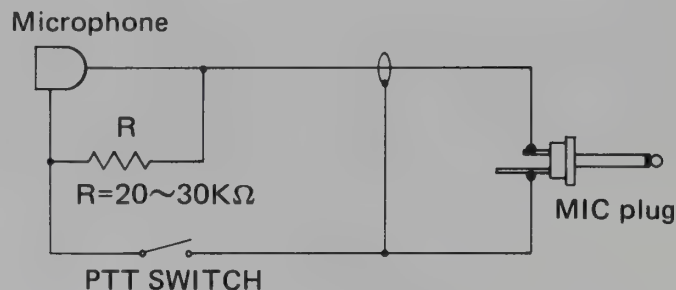
Most repeaters require a 1750Hz Tone-burst for initial access. Depressing the VOLUME CONTROL knob for the required period for a repeater, puts the set in the transmit mode and the tone burst generator actuates and you can access the repeater.

⑤ **EXTERNAL MIC JACK**

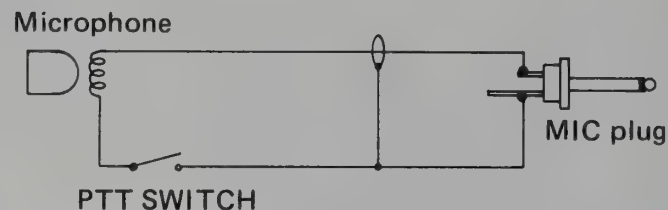
When an external microphone is used, connect it to this jack. See the schematic for the proper hookup. When the external microphone is connected the built-in microphone does not function. The IC-HM9 optional speaker-microphone can also be used.



### Electret condenser microphone



### Dynamic microphone



## ⑥ EXTERNAL SPEAKER JACK

When an external speaker (or an earphone) is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected the built-in speaker does not function.

## ⑦ POWER SWITCH

The ON/OFF switch controls the supplied power to the set.

## ⑧ 5KHz SHIFT SWITCH

When the desired operating frequency has a 5KHz digit, set this switch in the +5KHz position, and add 5KHz to the indicated frequency on the thumbwheel switches.

⑨ **10KHz THUMBWHEEL SWITCH**

Sets 10KHz digit of the desired operating frequency.

⑩ **100KHz THUMBWHEEL SWITCH**

Sets 100KHz digit of the desired operating frequency.

⑪ **1MHz THUMBWHEEL SWITCH**

Sets 1MHz digit of the desired operating frequency. When you set a digit of a frequency that is out of the band, the set will work as follows:

Digit	Actual Working frequency band	
	IC-2A - IC-2AT	IC-2E
0	144MHz	144MHz
1	145	145
2	146	144
3	147	145
4	144	144
5	145	145
6	146	144
7	147	145
8	144	144
9	145	145

⑫ **PUSH TO TALK (PTT) SWITCH**

For transmission, press this switch and talk into the microphone with normal voice. The internal microphone is of the electret-condenser type and provides good pickup for all levels of voice.

### **\*TWO-TONE ENCODER PAD**

IC-2AT has a standard two-tone encoder pad on the front panel. The pad can be used for auto-patch, accessing to closed repeater, and/or other controls.

#### **⑬ RF POWER SWITCH**

Selects the RF output power HIGH 1.5 Watt (at 8.4V) or LOW 0.15 Watt (at 8.4V). In the LOW position, the current drain is decreased, to prolong the battery life.

#### **⑭ DUPLEX/SIMPLEX SWITCH**

Selects the operation mode DUPLEX for repeater operation, or SIMPLEX for the same receive/transmit frequency operation.

#### **⑮ DUPLEX MODE SWITCH**

In the DUPLEX mode, selects the transmitting frequency, 600KHz above or below the receiving frequency according to the desired repeater input frequency.

#### **⑯ CHARGER CONNECTOR**

Connects to the output plug of the wall charger BC-25U/E or other power source.

#### **⑰ BATTERY CHARGE INDICATOR**

Lights during battery charging.



## SECTION VI OPERATION

### RECEIVING

Make sure the ⑧ POWER SWITCH is in the OFF position, and before turning ON the power switch, confirm as follows:

1. Make sure the battery pack is properly charged and attached to the set.
2. Make sure the supplied flexible antenna is properly set.

When an external antenna is employed, make sure the coaxial line is of the correct impedance (50 ohms) and is neither shorted nor opened, and is firmly connected to the antenna connector.

Set the controls and switches as follows:

- |   |  |
|---|--|
| ③ SQUELCH CONTROL                               | Completely counterclockwise                                      |
| ④ VOLUME CONTROL                                | Completely counterclockwise                                      |
| ⑨~⑩ THUMBWHEEL SWITCHES and ⑦ 5KHz SHIFT SWITCH | Desired frequency<br>(Others may be at any position or setting.) |

Set the ⑧ power switch to the ON position.

Turn the ④ VOL control clockwise to a comfortable audio level.

If no signal can be heard but only noise, turn the ③ SQL control clockwise until the noise from the speaker stops and set it just below this threshold. (When adjusting the SQL setting, if some communication signals can be heard, turn the thumbwheel switch either direction and set it where only noise can be heard.) Your transceiver will now remain silent until an in-coming signal is received which opens the squelch. If the squelch is unstable due to the reception of weak or mobile stations, adjust the squelch control further until the proper threshold is obtained.

## TRANSMITTING

Set the controls and switches as follows:

- |                         |             |
|-------------------------|-------------|
| ⑭ DUPLEX/SIMPLEX SWITCH | (see below) |
| ⑮ DUPLEX MODE SWITCH    | (see below) |
| ⑬ RF Power Switch       | HIGH        |

For simplex operation, set ⑭ DUPLEX/SIMPLEX SWITCH at the SIMPLEX position, making ⑮ DUPLEX MODE SWITCH nonfunctional.

For repeater operation, set ⑭ DUPLEX/SIMPLEX SWITCH at DUPLEX and select whether the transmitting frequency is to be 600KHz above (+600) or below (−600) the receiving frequency.

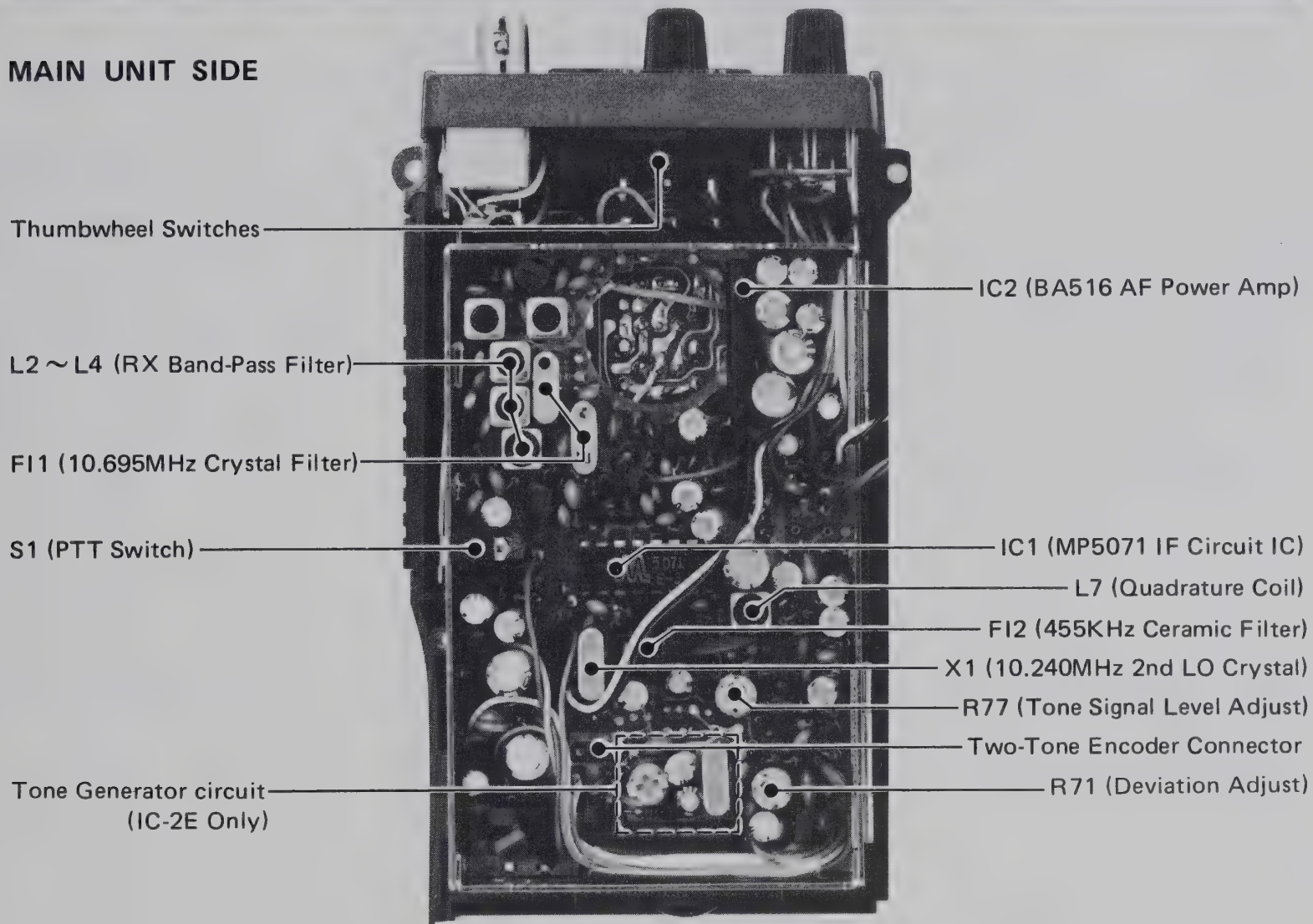
If the lower output power is sufficient, set ⑬ RF Power Switch to the LOW position.

Depress the ⑫ PTT switch for transmitting and release for receiving. Speak into the microphone with your normal speech level for the proper microphone level.

If you need a tone-burst for initial access of the repeater, depress the ④ Tone Call Switch for the required period. (Tone-burst periods vary individually from 100 milliseconds to 2 seconds.)  
(IC-2E independent tone type only)

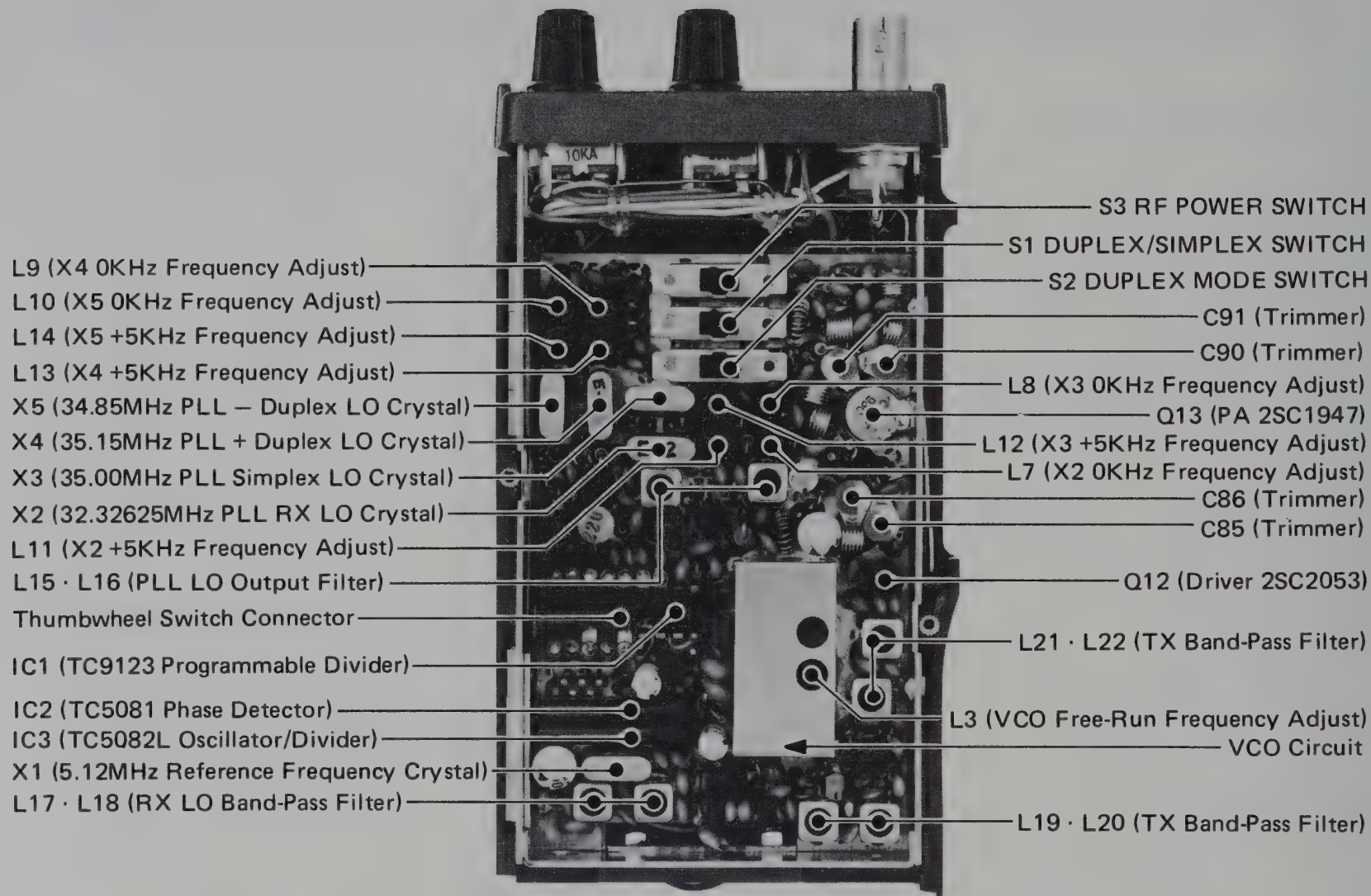
## SECTION VII INSIDE VIEW

### MAIN UNIT SIDE





## PLL UNIT SIDE



## SECTION VIII TROUBLE SHOOTING

Your IC-2A(T)/E has been tested very carefully at the factory before shipping. The chart below has been designed to help you correct any problems which are not equipment malfunctions. If you are not able to locate the problem and/or solve it through use of this chart, please contact your dealer or ICOM distributor for assistance.

Problem	Possible Cause	Solution
1. Power does not come ON when the switch is turned.	Bad connection of the battery pack.	Check the connection of the battery pack and correct any problems.
	Reverse polarity of the battery (when using IC-BP4)	Make sure of the polarity of each battery and replace them into the pack.
	The battery has been exhausted.	Replace the battery with a new one or recharge it.
2. No sound comes from the speaker.	VOLUME CONTROL knob is completely counterclockwise.	Turn the knob clockwise to a suitable level.
	The unit is in the transmit mode, by the PTT switch.	Put the unit in the receive mode.

Problem	Possible Cause	Solution
2. No sound comes from the speaker.	<p>SQUELCH setting is turned too far clockwise.</p> <p>External speaker (or earphone) is in use.</p> <p>The battery has been exhausted.</p>	<p>Turn the SQUELCH CONTROL counterclockwise until noise can be heard and reset it just below the threshold.</p> <p>Check if the external speaker plug is inserted properly or if the external speaker cable is cut.</p> <p>Replace the battery with a new one or recharge it.</p>
3. Sensitivity is low and only strong signals are audible.	<p>Bad connection of the flexible antenna.</p> <p>The antenna feed line is cut or shorted. (When using an external antenna.)</p>	<p>Check the connection of the antenna and correct any problems.</p> <p>Check the feed line and correct any improper condition.</p>
4. No or low RF output.	<p>RF Power switch is set at the Low position.</p> <p>The battery has been exhausted.</p> <p>The antenna feed line is cut or shorted.</p>	<p>Set the RF Power switch to the High position.</p> <p>Replace the battery with a new one or recharge it.</p> <p>Check the antenna feed line and correct any problems.</p>



Problem	Possible Cause	Solution
<p>5. No modulation. (When using external microphone.)</p>	<p>Bad connection of the MIC connector.</p> <p>The MIC cable is cut.</p>	<p>Check the connection of the MIC connector and correct any problems.</p> <p>Repair the disconnected or cut wire.</p>
<p>6. The receive mode functions properly and your signals are transmitted, but you are unable to make contact with another station. (When desiring DUPPLEX mode.)</p> <p>(When desiring, SIMPLEX mode.)</p>	<p>The DUPLEX/SIMPLEX Switch is in the SIMP position.</p> <p>Improper input/output frequency of the repeater.</p> <p>The DUPLEX/SIMPLEX Switch is in the DUP position.</p>	<p>Set the DUPLEX/SIMPLEX Switch in the DUP position, and the DUPLEX MODE Switch in +600 or -600 position according to repeater input/output frequency.</p> <p>Set the DUPLEX/SIMPLEX Switch in the SIMP position</p>

## SECTION IX VOLTAGE CHARTS

**NOTE:** Measuring instrument is a 50K $\Omega$ /V multimeter.

### MAIN UNIT TRANSISTORS

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q 1	0		0	GND	0.75		1.9	GND	
Q 2	0		0	0	2.2		5.5	1.9	
Q 3	0		0	0	0		5.4	1.6	
Q 4	0		0	GND	0.7		0.9	GND	
Q 5	0		0	0	1.6		2.2	0.9	
Q 6	4.2		4.8	5.0	0		4.9	5.0	
Q 7	0		0.7	GND	0		0.3	GND	
Q 8	0.7		0	GND	0.3		4.1	GND	
Q 9	4.6		0	5.6	4.2		4.9	5.0	
Q10	0		8.2	0	4.9		8.4	4.4	
Q11	7.8		0	8.4	7.8		5.6	8.4	
Q12	4.8		7.9	4.2	0		8.4	0	
Q13	0		0.5	0	3.7		1.5/0	2.8/3.4	IC-2E/A
Q14	0.6		0	GND	0.6/0		0/8.2	GND	IC-2E/A
Q15	0		7.8	0	0/8.2		7.8	0/7.6	IC-2E/A
Q16	7.8		0	8.4	7.8		7.6/0	8.4	

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q17	0.6		8.4	2.0	5.0		8.4	2.0	
Q18	8.2		5.0	8.4	8.4		5.0	8.4	
Q19	0.6		8.2	GND	0.5		8.4	GND	
Q20	0.6		0.6	GND	0.6		0.5	GND	
Q21	5.7		3.4	5.0	5.8		0	5.0	
Q22	3.4		4.0	4.2	0		0	0	
Q23	4.8		3.8	3.9	3.2		1.3	5.0	
Q24	0.6		0	GND	0		4.9	GND	
Q25	2.4		4.2	2.0	0		0	0	
Q26	2.6		3.6	2.0	0		0	0	
Q27	3.6		2.6	4.1	0		0	0	
Q28	0.6		2.0	GND	0		0	GND	
Q29	2.1		4.2	1.9	0		0	0	
Q30	0/4.9		4.4/7.7	2.6/4.9	0/0		0/7.8	0/0	IC-2E/A
Q31	4.4/8.3		8.4/6.1	4.0/8.4	0/8.4		8.4/0	0/8.4	IC-2E/A
Q32	0		0.6	GND	0		0.6	GND	IC-2AT only



## PLL UNIT TRANSISTORS

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q 1	0		4.0	0.8	0		4.0	0.75	
Q 2	0.7		1.0	GND	0.7		1.0	GND	
Q 3	1.6		2.9	1.0	1.6		2.9	1.0	
Q 4	0.7		0.7	GND	0.7		0.7	GND	
Q 5	1.4		3.4	0.9	1.4		3.4	0.9	
Q 6	1.3		4.9	0.8	1.3		4.9	0.8	
Q 7	0		0	1.5	2.0		4.4	1.7	
Q 8	0.5		1.5	GND	0.5		1.7	GND	
Q 9	1.8		4.4	1.5	0		0	1.7	
Q10	0		1.2	GND	0.7		0	GND	
Q11	1.1		8.2	0.5	0		9.0	0	
Q12	0.55		8.6	0.1	0		9.0	0	Power HIGH
Q13	1.2		8.8	GND	0		9.0	GND	
Q14	4.6		0	5.0	4.6		0	5.0	

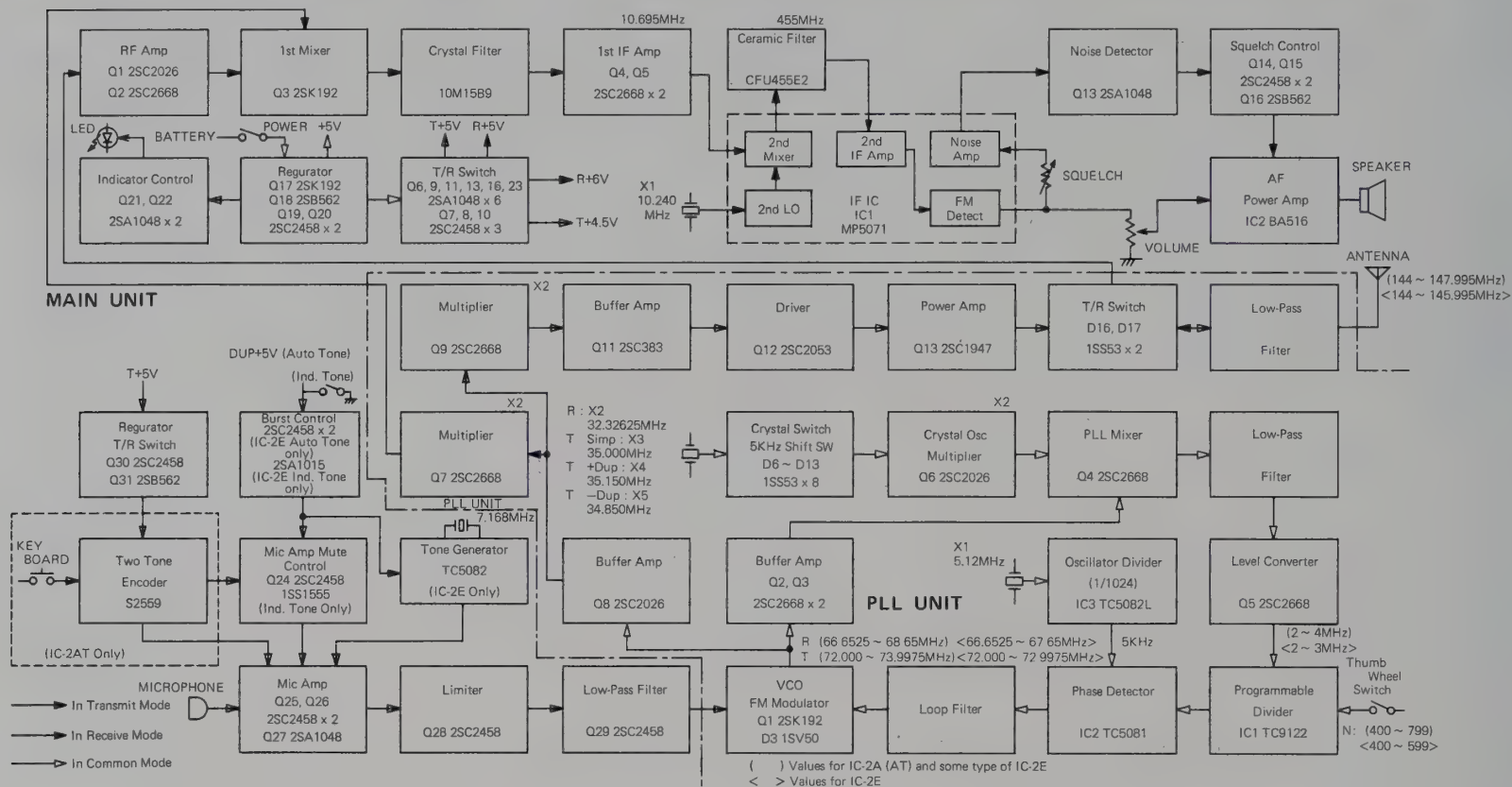
## IN TRANSMIT MODE

UNIT	IC No.	PIN No.																		REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MAIN	IC1	0	0	0	0	0	0	0	0	0	0	0	GND	0	0	0	0			
MAIN	IC2	0	0	0	0	GND	0	0	0	0										
MAIN	IC3	0.8	1.4	1.6	1.8	4.0	2.0	2.0	2.0	GND										IC-2E only
PLL	IC1	5.0	1.6	0	0	0	0	0	0	0	0	4.4	0	4.4	0	0	0	0	GND	f=145MHz
PLL	IC2	0	4.4	1.2	5.0	5.0	0	0	2.4	GND										
PLL	IC3	0.9	1.4	1.8	0	5.0	0	2.4	2.4	GND										
TOUCH TONE	IC1	6.1	5.7	6.1	6.1	6.1	GND	0	6.1	6.1	0	0	0	0	0	4.4	0			IC-2AT only

## IN RECEIVE MODE

UNIT	IC No.	PIN No.																		REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MAIN	IC1	4.2	5.0	5.3	5.6	0.9	0.9	1.1	5.6	2.9	2.0	2.1	GND	5.1	0		2.0			
MAIN	IC2	6.1	4.3	7.6	3.6	GND	3.6	3.6	3.4	3.4										SQL OPEN
MAIN	IC3	0	0	0	0	0	0	0	0	GND										IC-2E only
PLL	IC1	5.6	1.6	0	0	0	0	0	0	0	0	4.4	0	4.4	0	0	0	0	GND	f=145MHz
PLL	IC2	0	4.4	1.2	5.0	5.0	0	0	2.4	GND										
PLL	IC3	0.9	1.4	1.8	0	5.0	0	2.4	2.4	GND										
TOUCH TONE	IC1	0	0	0	0	0	GND	0	0	0	0	0	0	0	0	0	0			IC-2AT only

# SECTION X BLOCK DIAGRAM





## SECTION XI OPTIONS

We have prepared a variety of options for the transceiver IC-2A(T)/E in order to enlarge its use.

**1. BC-30 Nickel-Cadmium Battery Charger**

A convenient set-in type charger for Nickel-Cadmium battery packs. Two charging rates provided - high speed and regular rate. The charger is compatible with any type of Nickel-Cadmium batteries packs.

**2. IC-BP2 Nickel-Cadmium Battery Pack**

This battery pack has six AA type 450mAH Nickel-Cadmium batteries and provides 1 Watt output power for the IC-2A(T)/E with attendant longer use capability. Recharge time, when using the BC-30 is 1-1/2 hours.

**3. IC-BP4 Battery Case**

This case will accept dry batteries, zinc or alkaline, for 1.5W output, or Nickel-Cadmium for 1 Watt output power. It holds six cells. When Nickel-Cadmium are installed the BC-30 can be used to recharge the batteries.

**4. IC-BP5 Nickel-Cadmium Battery Pack**

This battery pack has nine AA type 450mAH Nickel-Cadmium batteries and provides 2.3 Watts output power, plus longer operating capability. It can be recharged by the BC-30 in 1-1/2 hours.

**5. IC-CP1 Cigarette Lighter Recharger for IC-BP3**

A handy way to recharge the Nickel-Cadmium packs while mobile - plugs in the cigarette lighter.

**6. IC-HM9 Speaker/Microphone**

A handy speaker and microphone in one unit. Clips on the clothing and operates as both speaker and microphone when plugged in the unit.

**7. Leather Case**

A soft leather case designed specifically for the IC-2A(T)/E as a convenient, protective case when the set is used outdoors.



# **ICOM INCORPORATED**

1-6-19, KAMI KURATSUKURI, HIRANO-KU,  
OSAKA JAPAN

Printed in Japan  
A-0267

# **IC-2A/AT/E**

**144MHz FM TRANSCEIVER**

## **INSTRUCTION MANUAL**







**ICOM**

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## **SECTION I INTRODUCTION**

### **SYNTHESIZED HAND HELD TRANSCEIVER**

Small, light, and 800 channels capability,\* a handy for use any time, whether outdoors, in a car, or at home, 800 channels for use on any 2 meter frequency, or any repeater.

- \* IC-2Au     800 channels
- IC-2Ao     800 channels
- IC-2AT     800 channels with Touch Tone Encoder
- IC-2EDL    400 channels with Independent Tone Type
- IC-2Ei     800 channels with Independent Tone Type

### **DUAL POWER LEVEL**

Transmitter output can be switched easily to either of two levels; 1.5W output HIGH for long distances, and 0.15W LOW for short distances. Battery consumption is minimized in the Low Power Mode. IC-BP5, Power Pack as option, gives 2.3W output.

### **VARIOUS POWER PACKS AVAILABLE**

The Power Pack is slipped on the bottom of the radio very easily, and various power packs are available to suit your needs, for minimum size, longer use, or higher power.

## SECTION II SPECIFICATIONS

### GENERAL

Number of Semi-conductors	Transistors 43 (42) < 41> FET 3 IC 5 [6] (6) Diodes 21 (20)
Frequency Coverage	144.000 ~ 147.995MHz: IC-2Au, IC-2Ao, IC-2AT, IC-2E1 144.000 ~ 145.995MHz: IC-2EDL
Frequency resolution	5KHz steps 800 channels or 400 channels
Frequency Control	Digital PLL synthesizer, with thumb wheel switch
Frequency stability	Within $\pm 1.5\text{KHz}$
Usable Temperature	$-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$ ( $14^{\circ}\text{F} \sim 140^{\circ}\text{F}$ )
Antenna impedance	50 ohms unbalanced
Power supply requirement	DC 8.4V; with attendant power pack IC-BP3, DC 6 ~ 12V negative ground is acceptable
Current drain at 8.4V	Transmitting HIGH : 1.5W Approx. 550mA LOW : 0.15W Approx. 220mA Receiving At max audio output Approx. 130mA Squelched Approx. 20mA
Dimensions	116.5mm (H) x 65mm (W) x 35mm (D) Without power pack Attendant power pack, IC-BP3 49mm (H) x 65mm (W) x 35mm (D)
Weight	470g [490g] including power pack, IC-BP3 and flexible antenna



## TRANSMITTER

Output power	HIGH: 1.5W, LOW: 0.15W at 8.4V
Emission mode	16F <sub>3</sub>
Modulation system	Variable reactance frequency modulation
Max. frequency deviation	±5KHz
Spurious emission	More than 60dB below carrier
Microphone	Built-in Electret condenser microphone Optional Speaker-microphone can be used (IC-HM9)
Operating mode	Simplex Duplex ±600KHz from receive frequency

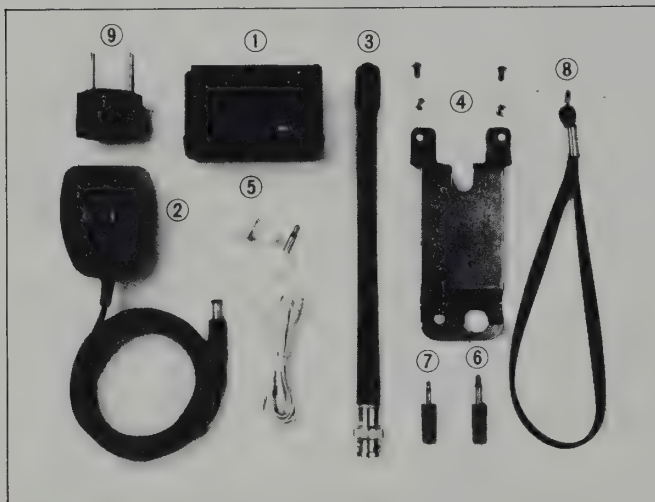
## RECEIVER

Receiving system	Double-conversion superheterodyne
Modulation acceptance	16F <sub>3</sub>
Intermediate frequency	1st: 10.695MHz 2nd: 455KHz
Sensitivity	More than 26dB S+N+D/N+D at 1μV Less than 0.5μV for 20dB Noise quieting
Squelch sensitivity	Less than 0.4μV
Spurious response rejection ratio	More than 60dB
Selectivity	More than ±7.5KHz at -6dB point Less than ±15KHz at -60dB point
Audio output power	More than 300mW
Audio output impedance	8 ohms

**Note:** [ ] Values for IC-2AT ( ) Values for IC-2Au and IC-2Ao < > Values for IC-2EDL and IC-2EI Specifications are approximate and are subject to change without notice or obligation.

## SECTION III ACCESSORIES

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Various accessories are packed with the transceiver. Make sure you have not overlooked anything.



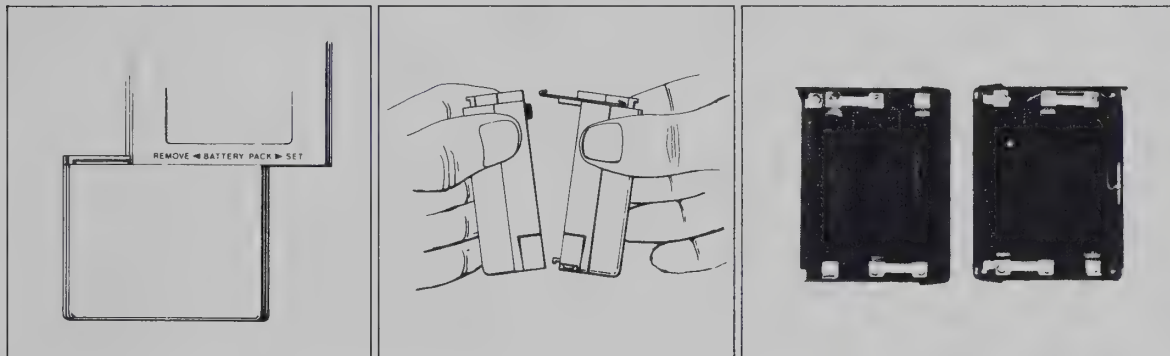
- |  |   |
|--|---|
| 1. Power pack IC-BP3 .....                     | 1 |
| 2. Wall charger BC-25U/E.* .....               | 1 |
| 3. Flexible antenna .....                      | 1 |
| 4. Belt clip. ....                             | 1 |
| 5. Earphone. ....                              | 1 |
| 6. Earphone plug .....                         | 1 |
| 7. Microphone plug. ....                       | 1 |
| 8. Hand-strap. ....                            | 1 |
| 9. Ac conversion plug (Universal type)** ..... | 1 |
| * BC-25U for 117V                              |   |
| * BC-25E for 240V                              |   |
| ** for IC-2Ao, IC-2EDL and IC-2Ei only         |   |

## SECTION IV PRE-OPERATION

### BATTERY INSTALLATION

When using alkaline power pack IC-BP4:

Place the power switch in the OFF position. Remove the power pack from bottom of the set by pushing the pack in the indicated direction. Separate the pack into two parts (case) as follows:



Each case holds three AA type batteries. Install batteries into each case, according to indicated polarity. With the batteries properly in place, carefully replace the pack and slip it onto the set with the reverse procedure.

Also, AA type Nickel-Cadmium, rechargeable, batteries can be used. But the charger for them should be the optional BC-30 charger.

## **WHEN TO REPLACE BATTERIES (When using alkaline batteries).**

When the Transmit Indicator LED does not light up during transmission, the batteries are exhausted. Use batteries of the same type, for mixed types might cause leakage. Replace worn batteries with a complete new set. If used with old batteries, the life of new ones might be shortened. Battery life is shortened more by transmitting than by receiving, since several times more current is drawn in transmit. To prolong battery life, therefore, practice as follows:

- \* Try to minimize the transmit period.
- \* Reduce volume during reception.
- \* Be sure to cut off power source when set is not used.

More working hours are available if high-performance batteries are employed.

When using Nickel-Cadmium power pack IC-BP3:

The IC-BP3 is a rechargeable Nickel-Cadmium power pack, and it can be slipped onto or off of the set very easily. It has a connector for a charger charge-current control circuit, reverse polarity protection circuit and charge indicator LED in its own pack. You can use the supplied BC-25U/E wall charger or similar simple wall charger, or a car battery by using optional cable IC-CP1 for recharging. Before use, the power pack should be charged about 15 hours, because the battery may have discharged. (Refer "How to charge" on page 7.)

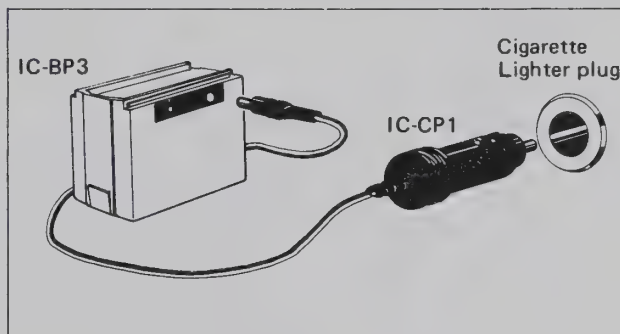
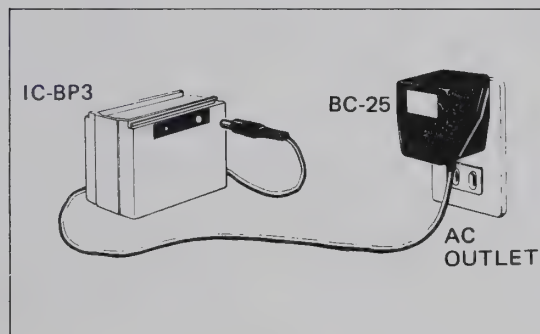
After charging is completed, the batteries can be used in the same manner as dry cells. However, the voltage of Nickel-Cadmium batteries drops rapidly just before they are exhausted, so when the Transmit Indicator LED of the transceiver goes out, be sure to immediately stop using it, and charge the batteries again.



## HOW TO CHARGE (When using Nickel-Cadmium power pack IC-BP3).

1. Use the supplied wall charger BC-25U/E or a stable power source with an output voltage of DC 13.8V and current capacity over 50mA, or use a 12V car battery with optional charger cable IC-CP1. (Output voltage of 12~15V can be used, but output voltage near the specified voltage should be used.)
2. The power switch of the transceiver must be OFF, or remove the power pack from the transceiver.
3. Connect the output plug of the wall charger (BC-25U/E), or other power source, to the charger socket of the power pack. (When charging Nickel-Cadmium batteries in the IC-BP4 power pack, you should use the BC-30 charger only.)

The charge indicator LED of the power pack is lit, which shows that the charger is working.



4. It takes about 15 hours to charge the batteries completely. This charger is designed for 0.1°C (10-hour rate current), but charge for 15 hours in order to compensate for any unbalance of the batteries.

You should charge the batteries for 15 hours when you have not used them for a long time or after buying them.

5. Charge between 0°C and 40°C.
6. Avoid continuing charging as much as possible after full charging, (15 hours). If excess charging is repeated, efficiency of the power pack is reduced.
7. After charging, unplug the plug of the power source from the charger socket of the power pack. The transceiver and the power pack is now ready for operation.

## **PRECAUTIONS FOR USE OF THE NICKEL-CADMIUM BATTERIES**

**(from the JIS C8705 MANUAL)**

### **General Cautions**

1. Never short the power pack.  
Since internal resistance is low, excess shorted current flows away, causing the batteries or conductors to burn. Avoid shorts! Label showing polarity is put on the power pack.
2. Never solder the batteries directly.  
If the batteries are soldered directly, the separator or insulator may be melted and damaged. Accordingly, the terminal must be spot-welded first and then soldered.
3. Confirm polarities in order to prevent reverse charging. If they are charged in reverse, batteries may be damaged. Therefore confirmation of correct polarity is essential.
4. Never charge with excess charging current.  
If an excess charging rate is employed, gas consumption speed cannot keep up with gas generating speed at the time of charging. Batteries may be damaged by increasing internal pressure. Accordingly, the charging must be kept regulated.

5. Avoid charging under 0°C or over 40°C.

Under 0°C, since gas consumption speed becomes lower at the charging time, inside pressure increases and hydrogeon is generated. Since charging efficiency is reduced over 40°C, it is rather difficult to charge. Accordingly, charging must be done between 0°C and 40°C.

6. Never put batteries into fire.

Since there may be a little gas left in the batteries, internal pressure increases suddenly and the batteries explode if thrown into a fire. Also, battery electrolyte is ejected and can cause damage to skin and clothes.

### **FOR OUTDOOR USE**

1. Attach the supplied power pack. (Refer to "BATTERY INSTALLATION")
2. Attach the supplied hand strap and belt clip through the fixture on the body (as shown in the drawings on page 10).
3. Attach the flexible rubber antenna.

### **FOR USE IN THE CAR**

1. Avoid using the unit near the outlet of heaters, air-conditioners, etc.
2. Put the unit in a convenient place to avoid disrupting safe driving.
3. Firmly ground to the car body a mobile antenna (e.g. whip antenna) that requires it.

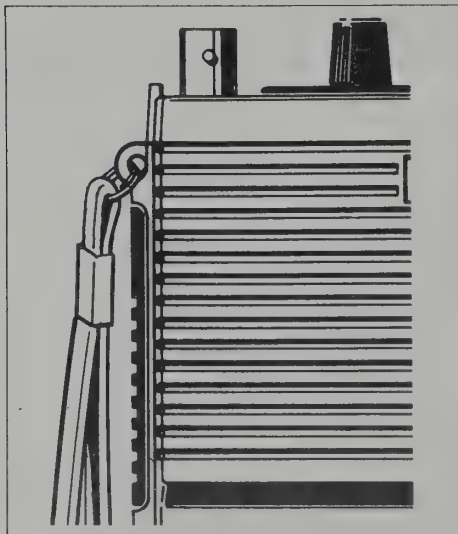
### **FOR FIXED USE**

1. Avoid putting the unit in places exposed to rain, water splash, direct sunshine, dust, vibration, or heat.
2. An external antenna should be used for indoor operation. The use of the flexible antenna indoors may cause TVI, BCI, Hi-Fi interference, malfunction of stabilized DC power supply.

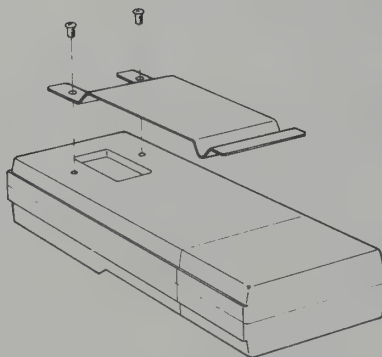
## EXTERNAL ANTENNA

1. Select a high performance antenna (a multi-element beam or gain antenna) and set it up in the highest possible position.
2. Use a 50 ohm antenna and coaxial cable.
3. On VHF, the power loss in the antenna cable is large, so use a cable with the lowest possible loss and make it as short as possible.
4. Use a BNC plug for connection to the unit.

## ATTACHMENT OF HAND STRAP AND BELT CLIP



- Attach the belt clip on the back cover with 2 screws supplied.

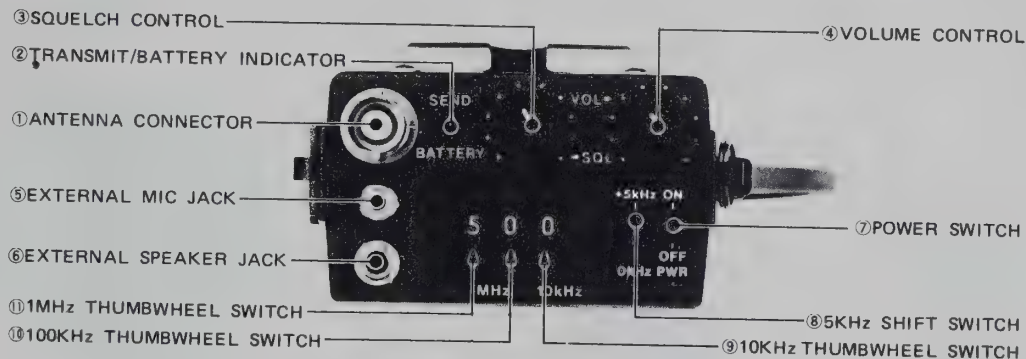




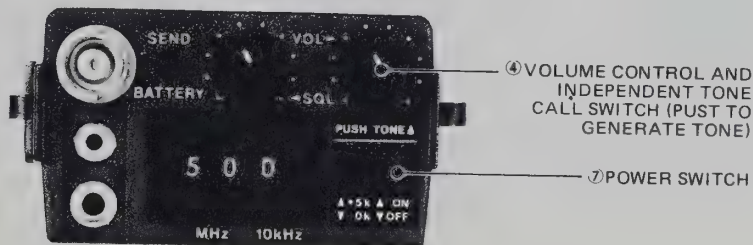
## SECTION V CONTROL FUNCTIONS

### TOP PANEL

[IC-2Au, IC-2Ao, IC-2AT]



[IC-2EdL, IC-2Ei]



## FRONT PANEL

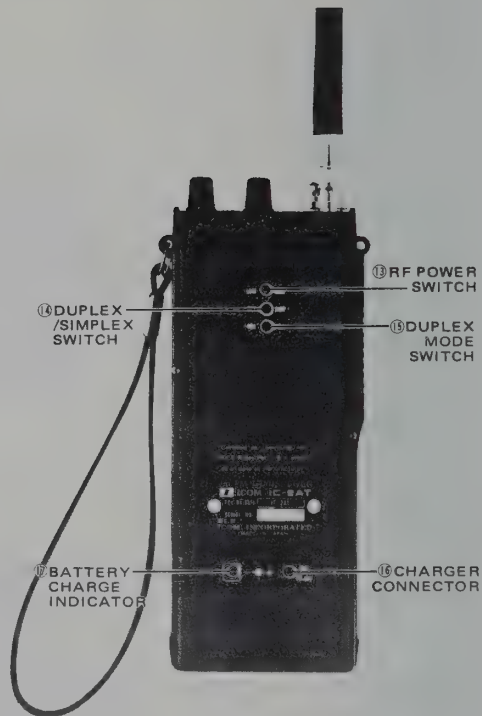


IC-2A, IC-2E



IC-2AT

## REAR PANEL



① **ANTENNA CONNECTOR**

Connect the supplied flexible antenna. An external antenna can be used, using a BNC connector.

② **TRANSMIT/BATTERY INDICATOR**

Illuminates in the transmit mode. Also indicates the battery condition; during transmission. The voltage of Nickel-Cadmium batteries drops rapidly just before they are exhausted, so when this indicator goes out, be sure to immediately stop using it, and charge the batteries again.

③ **SQUELCH CONTROL**

Sets the squelch threshold level. To turn OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

④ **VOLUME CONTROL (and TONE CALL SWITCH)**

Controls the audio output level in the receive mode. Clockwise rotation increases audio output.

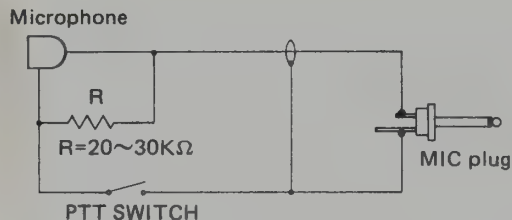
**TONE CALL SWITCH (IC-2E independent tone type only)**

Most repeaters require a 1750Hz Tone-burst for initial access. Depressing the VOLUME CONTROL knob for the required period for a repeater, puts the set in the transmit mode and the tone burst generator actuates and you can access the repeater.

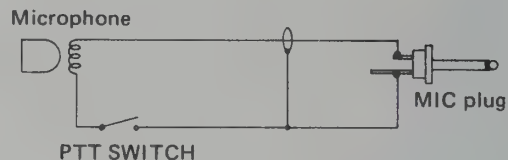
⑤ **EXTERNAL MIC JACK**

When an external microphone is used, connect it to this jack. See the schematic for the proper hookup. When the external microphone is connected the built-in microphone does not function. The IC-HM9 optional speaker-microphone can also be used.

### Electret condenser microphone



### Dynamic microphone



#### ⑥ EXTERNAL SPEAKER JACK

When an external speaker (or an earphone) is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected the built-in speaker does not function.

#### ⑦ POWER SWITCH

The ON/OFF switch controls the supplied power to the set.

#### ⑧ 5KHz SHIFT SWITCH

When the desired operating frequency has a 5KHz digit, set this switch in the +5KHz position, and add 5KHz to the indicated frequency on the thumbwheel switches.



⑨ **10KHz THUMBWHEEL SWITCH**

Sets 10KHz digit of the desired operating frequency.

⑩ **100KHz THUMBWHEEL SWITCH**

Sets 100KHz digit of the desired operating frequency.

⑪ **1MHz THUMBWHEEL SWITCH**

Sets 1MHz digit of the desired operating frequency. When you set a digit of a frequency that is out of the band, the set will work as follows:

Digit	Actual Working frequency band	
	IC-2Au, IC-2Ao, IC-2AT, IC-2Ei	IC-2EDL
0	144MHz	144MHz
1	145	145
2	146	144
3	147	145
4	144	144
5	145	145
6	146	144
7	147	145
8	144	144
9	145	145

⑫ **PUSH TO TALK (PTT) SWITCH**

For transmission, press this switch and talk into the microphone with normal voice. The internal microphone is of the electret-condenser type and provides good pickup for all levels of voice.

### **\*TWO-TONE ENCODER PAD**

IC-2AT has a standard two-tone encoder pad on the front panel. The pad can be used for auto-patch, accessing to closed repeater, and/or other controls.

### **⑬ RF POWER SWITCH**

Selects the RF output power HIGH 1.5 Watt (at 8.4V) or LOW 0.15 Watt (at 8.4V). In the LOW position, the current drain is decreased, to prolong the battery life.

### **⑭ DUPLEX/SIMPLEX SWITCH**

Selects the operation mode DUPLEX for repeater operation, or SIMPLEX for the same receive/transmit frequency operation.

### **⑮ DUPLEX MODE SWITCH**

In the DUPLEX mode, selects the transmitting frequency, 600KHz above or below the receiving frequency according to the desired repeater input frequency.

### **⑯ CHARGER CONNECTOR**

Connects to the output plug of the wall charger BC-25U/E or other power source.

### **⑰ BATTERY CHARGE INDICATOR**

Lights during battery charging.



### **\*TWO-TONE ENCODER PAD**

IC-2AT has a standard two-tone encoder pad on the front panel. The pad can be used for auto-patch, accessing to closed repeater, and/or other controls.

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### **⑯ CHARGER CONNECTOR**

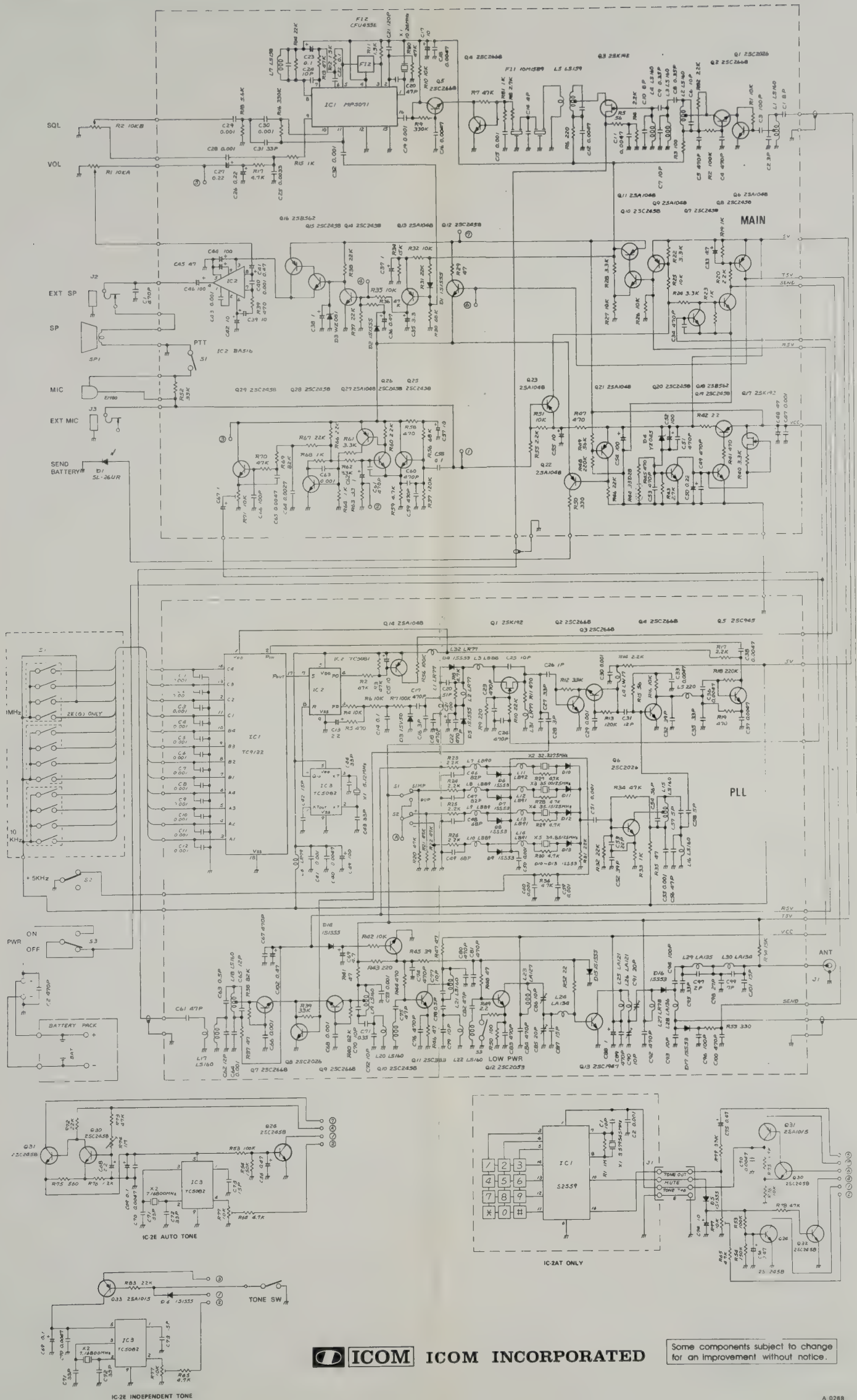
Connects to the output plug of the wall charger BC-25U/E or other power source.

### **⑰ BATTERY CHARGE INDICATOR**

Lights during battery charging.



## IC-2A/AT/E SCHEMATIC DIAGRAM











# ICOM INSTRUCTIONS

BATTERY PACKS AND CASE

BP-2 BP-3 BP-4  
BP-5 BP-5A BP-7  
BP-8 BP-70

## PRE-CAUTIONS

- NEVER** throw a battery pack into a fire since internal battery gas could cause an explosion.
- NEVER** put the battery pack in water. If the battery pack is wet, be sure to wipe it dry.
- NEVER** short the terminals on the top panel of the battery pack. Use the plastic insulator strip provided to prevent this when the battery pack is not attached to the transceiver.
- NEVER** replace the battery cells. NiCd battery packs can normally be recharged about 300 times. After this, a new battery pack must be purchased. (The batteries in BP-4 are replaceable.)
- NEVER** charge a battery pack from more than one power source.
- DO NOT** charge with battery chargers that are not recommended. Use the proper charger for each battery pack.
- AVOID** continuous charging after full charging. If excessive charging is repeated, efficiency of the battery pack is reduced.
- AVOID** charging for more than the specified periods shown in the table.

## CHARGING OPERATIONS

- Newly purchased battery packs, or those that have not been recharged for two months or longer, should be fully charged for optimum life and operation.
- Connect the appropriate charger to the battery pack, or insert the battery pack in a drop-in type charger as shown in Fig. 3.
- The BATTERY CHARGE INDICATOR lights up while charging unless a drop-in type AC BATTERY CHARGER is used.

## INTRODUCTION

A wide variety of optional NiCd rechargeable battery packs is available for ICOM's line of advanced handheld transceivers.

For maximum performance with your transceiver using these battery packs, please read these instructions thoroughly.

## BATTERY PACK NOTE:

The full charge capacity of NiCd batteries may be reduced if repeatedly charged with only partial discharge periods. This is called the Battery Memory Effect. If the battery capacity seems lower than when new, discharge the battery pack completely through normal use, then charge fully using the proper charger.

## BATTERY CASE INSTRUCTIONS

- Push and hold the sides of the BP-4 BATTERY CASE and push down on the top aluminum panel. (Fig. 1)



Fig. 1

- Load the batteries and slide the battery holder into the battery case. (Fig. 2)

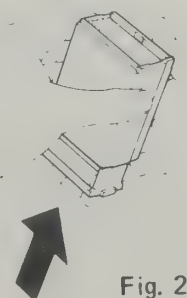


Fig. 2

## CHARGER CONNECTIONS

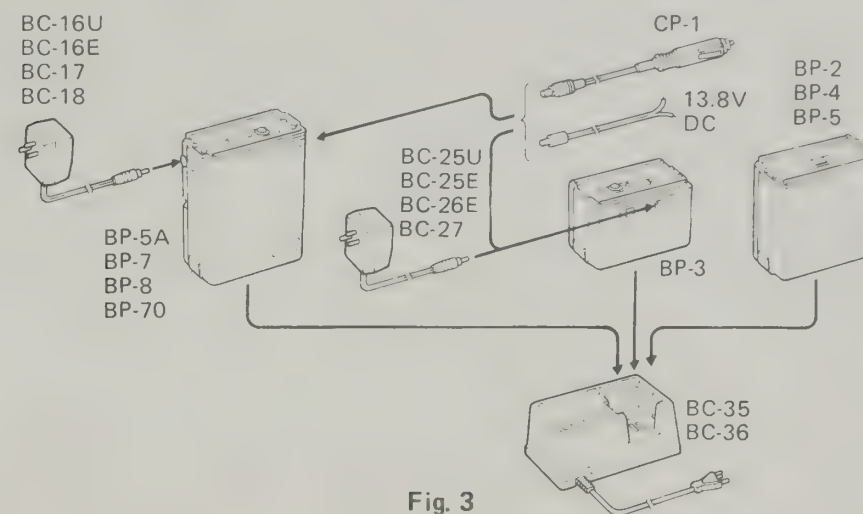


Fig. 3

## SPECIFICATIONS

MODEL	BATTERY CAPACITY	OUTPUT VOLTAGE	CHARGING PERIOD					HEIGHT
			BC-35 BC-36	BC-25U/E BC-26E BC-27	BC-16U/E BC-17 BC-18	CP-1	EXTERNAL DC POWER SOURCE	
BP-2	450mAh	7.2V	1.5hrs.	N/A	N/A	N/A	N/A	39mm
BP-3	270mAh	8.4V	15hrs.	15hrs.	N/A	15hrs.	15hrs.	39mm
BP-4	AA size x 6	9V or 7.2V	* 15hrs.	N/A	N/A	N/A	N/A	49mm
BP-5	450mAh	10.8V	1.5hrs.	N/A	N/A	N/A	N/A	56mm
BP-5A	450mAh	10.8V	1.5hrs.	N/A	15hrs.	15hrs.	15hrs.	80mm
BP-7	450mAh	13.2V	1.5hrs.	N/A	15hrs.	15hrs.	15hrs.	80mm
BP-8	800mAh	8.4V	3hrs.	N/A	15hrs.	15hrs.	15hrs.	80mm
BP-70	270mAh	13.2V	9hrs.	N/A	9hrs.	9hrs.	9hrs.	61mm

N/A: Not Applicable

\* **NEVER** charge zinc or alkaline batteries. Only replaceable NiCd batteries can be charged.

All stated specifications are approximate and subject to change without notice or obligation.

Icom Inc.

6-9-16, Kamihigashi, Hirano-ku, Osaka 547, Japan

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## SECTION VI OPERATION

### RECEIVING

Make sure the ⑧ POWER SWITCH is in the OFF position, and before turning ON the power switch, confirm as follows:

1. Make sure the power pack is properly charged and attached to the set.
2. Make sure the supplied flexible antenna is properly set.

When an external antenna is employed, make sure the coaxial line is of the correct impedance (50 ohms) and is neither shorted nor opened, and is firmly connected to the antenna connector.

Set the controls and switches as follows:

- |   |  |
|---|--|
| ③ SQUELCH CONTROL                               | Completely counterclockwise                                      |
| ④ VOLUME CONTROL                                | Completely counterclockwise                                      |
| ⑨~⑩ THUMBWHEEL SWITCHES and ⑦ 5KHz SHIFT SWITCH | Desired frequency<br>(Others may be at any position or setting.) |

Set the ⑧ power switch to the ON position.

Turn the ④ VOL control clockwise to a comfortable audio level.

If no signal can be heard but only noise, turn the ③ SQL control clockwise until the noise from the speaker stops and set it just below this threshold. (When adjusting the SQL setting, if some communication signals can be heard, turn the thumbwheel switch either direction and set it where only noise can be heard.) Your transceiver will now remain silent until an in-coming signal is received which opens the squelch. If the squelch is unstable due to the reception of weak or mobile stations, adjust the squelch control further until the proper threshold is obtained.

## TRANSMITTING

Set the controls and switches as follows:

- |   |                       |             |
|---|-----------------------|-------------|
| ⑭ | DUPLEX/SIMPLEX SWITCH | (see below) |
| ⑮ | DUPLEX MODE SWITCH    | (see below) |
| ⑬ | RF Power Switch       | HIGH        |

For simplex operation, set ⑭ DUPLEX/SIMPLEX SWITCH at the SIMPLEX position, making ⑮ DUPLEX MODE SWITCH nonfunctional.

For repeater operation, set ⑭ DUPLEX/SIMPLEX SWITCH at DUPLEX and select whether the transmitting frequency is to be 600KHz above (+600) or below (−600) the receiving frequency.

If the lower output power is sufficient, set ⑬ RF Power Switch to the LOW position.

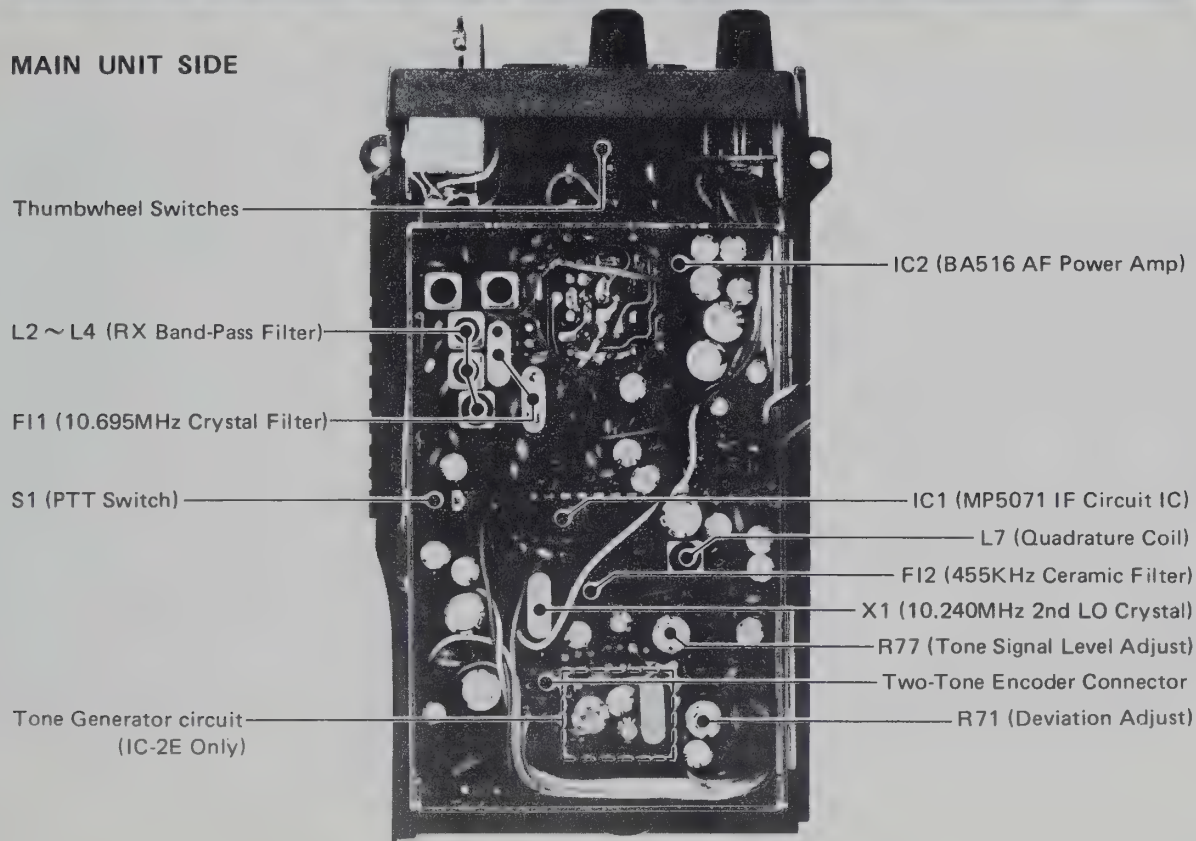
Depress the ⑫ PTT switch for transmitting and release for receiving. Speak into the microphone with your normal speech level for the proper microphone level.

If you need a tone-burst for initial access of the repeater, depress the ④ Tone Call Switch for the required period. (Tone-burst periods vary individually from 100 milliseconds to 2 seconds.)

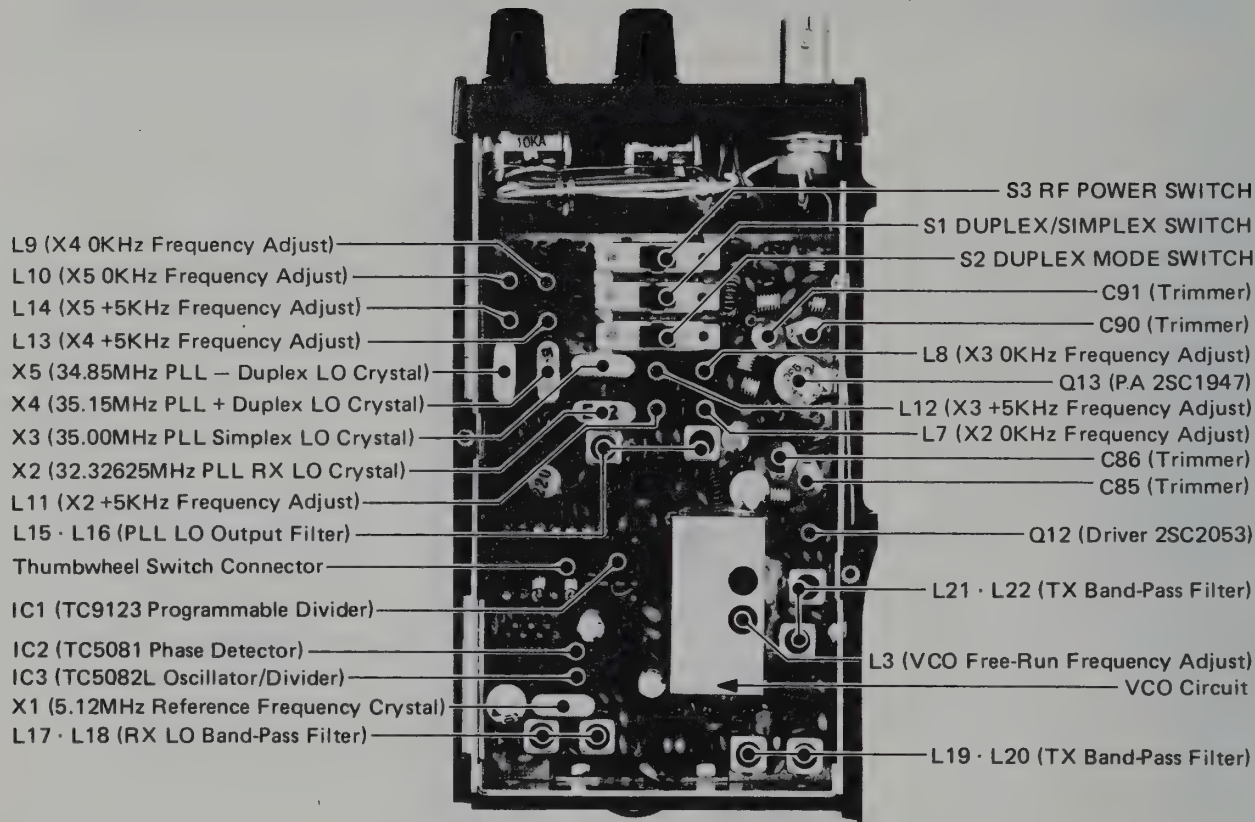


## SECTION VII INSIDE VIEW

### MAIN UNIT SIDE



## PLL UNIT SIDE



## SECTION VIII TROUBLE SHOOTING

Your IC-2A/AT/E has been tested very carefully at the factory before shipping. The chart below has been designed to help you correct any problems which are not equipment malfunctions. If you are not able to locate the problem and/or solve it through use of this chart, please contact your dealer or ICOM distributor for assistance.

Problem	Possible Cause	Solution
1. Power does not come ON when the switch is turned.	Bad connection of the power pack.	Check the connection of the power pack and correct any problems.
	Reverse polarity of the battery (when using IC-BP4)	Make sure of the polarity of each battery and replace them into the pack.
	The battery has been exhausted.	Replace the battery with a new one or recharge it.
2. No sound comes from the speaker.	VOLUME CONTROL knob is completely counterclockwise.	Turn the knob clockwise to a suitable level.
	The unit is in the transmit mode, by the PTT switch.	Put the unit in the receive mode.

Problem	Possible Cause	Solution
2. No sound comes from the speaker.	<p>SQUELCH setting is turned too far clockwise.</p> <p>External speaker (or earphone) is in use.</p> <p>The battery has been exhausted.</p>	<p>Turn the SQUELCH CONTROL counterclockwise until noise can be heard and reset it just below the threshold.</p> <p>Check if the external speaker plug is inserted properly or if the external speaker cable is cut.</p> <p>Replace the battery with a new one or recharge it.</p>
3. Sensitivity is low and only strong signals are audible.	<p>Bad connection of the flexible antenna.</p> <p>The antenna feed line is cut or shorted. (When using an external antenna.)</p>	<p>Check the connection of the antenna and correct any problems.</p> <p>Check the feed line and correct any improper condition.</p>
4. No or low RF output.	<p>RF Power switch is set at the Low position.</p> <p>The battery has been exhausted.</p> <p>The antenna feed line is cut or shorted.</p>	<p>Set the RF Power switch to the High position.</p> <p>Replace the battery with a new one or recharge it.</p> <p>Check the antenna feed line and correct any problems.</p>



Problem	Possible Cause	Solution
<p>5. No modulation. (When using external microphone.)</p>	<p>Bad connection of the MIC connector.</p> <p>The MIC cable is cut.</p>	<p>Check the connection of the MIC connector and correct any problems.</p> <p>Repair the disconnected or cut wire.</p>
<p>6. The receive mode functions properly and your signals are transmitted, but you are unable to make contact with another station. (When desiring DUPPLEX mode.)</p> <p>(When desiring, SIMPLEX mode.)</p>	<p>The DUPLEX/SIMPLEX Switch is in the SIMP position.</p> <p>Improper input/output frequency of the repeater.</p> <p>The DUPLEX/SIMPLEX Switch is in the DUP position.</p>	<p>Set the DUPLEX/SIMPLEX Switch in the DUP position, and the DUPLEX MODE Switch in +600 or -600 position according to repeater input/output frequency.</p> <p>Set the DUPLEX/SIMPLEX Switch in the SIMP position</p>

## SECTION IX VOLTAGE CHARTS

NOTE: Measuring instrument is a 50K $\Omega$ /V multimeter.

### MAIN UNIT TRANSISTORS

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q 1	0		0	GND	0.75		1.9	GND	
Q 2	0		0	0	2.2		5.5	1.9	
Q 3	0		0	0	0		5.4	1.6	
Q 4	0		0	GND	0.7		0.9	GND	
Q 5	0		0	0	1.6		2.2	0.9	
Q 6	4.2		4.8	5.0	0		4.9	5.0	
Q 7	0		0.7	GND	0		0.3	GND	
Q 8	0.7		0	GND	0.3		4.1	GND	
Q 9	4.6		0	5.6	4.2		4.9	5.0	
Q10	0		8.2	0	4.9		8.4	4.4	
Q11	7.8		0	8.4	7.8		5.6	8.4	
Q12	4.8		7.9	4.2	0		8.4	0	
Q13	0		0.5	0	3.7		1.5/0	2.8/3.4	IC-2E/A
Q14	0.6		0	GND	0.6/0		0/8.2	GND	IC-2E/A
Q15	0		7.8	0	0/8.2		7.8	0/7.6	IC-2E/A
Q16	7.8		0	8.4	7.8		7.6/0	8.4	

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q17	0.6		8.4	2.0	5.0		8.4	2.0	
Q18	8.2		5.0	8.4	8.4		5.0	8.4	
Q19	0.6		8.2	GND	0.5		8.4	GND	
Q20	0.6		0.6	GND	0.6		0.5	GND	
Q21	5.7		3.4	5.0	5.8		0	5.0	
Q22	3.4		4.0	4.2	0		0	0	
Q23	4.8		3.8	3.9	3.2		1.3	5.0	
Q24	0.6		0	GND	0		4.9	GND	
Q25	2.4		4.2	2.0	0		0	0	
Q26	2.6		3.6	2.0	0		0	0	
Q27	3.6		2.6	4.1	0		0	0	
Q28	0.6		2.0	GND	0		0	GND	
Q29	2.1		4.2	1.9	0		0	0	
Q30	0/4.9		4.4/7.7	2.6/4.9	0/0		0/7.8	0/0	IC-2E/A
Q31	4.4/8.3		8.4/6.1	4.0/8.4	0/8.4		8.4/0	0/8.4	IC-2E/A
Q32	0		0.6	GND	0		0.6	GND	IC-2AT only

# PLL UNIT TRANSISTORS

TR No.	TRANSMIT				RECEIVE				REMARKS
	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	BASE OR GATE1	GATE2	COLLECTOR OR DRAIN	EMITTER OR SOURCE	
Q 1	0		4.0	0.8	0		4.0	0.75	
Q 2	0.7		1.0	GND	0.7		1.0	GND	
Q 3	1.6		2.9	1.0	1.6		2.9	1.0	
Q 4	0.7		0.7	GND	0.7		0.7	GND	
Q 5	1.4		3.4	0.9	1.4		3.4	0.9	
Q 6	1.3		4.9	0.8	1.3		4.9	0.8	
Q 7	0		0	1.5	2.0		4.4	1.7	
Q 8	0.5		1.5	GND	0.5		1.7	GND	
Q 9	1.8		4.4	1.5	0		0	1.7	
Q10	0		1.2	GND	0.7		0	GND	
Q11	1.1		8.2	0.5	0		9.0	0	
Q12	0.55		8.6	0.1	0		9.0	0	Power HIGH
Q13	1.2		8.8	GND	0		9.0	GND	
Q14	4.6		0	5.0	4.6		0	5.0	



## IN TRANSMIT MODE

UNIT	IC No.	PIN No.																		REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MAIN	IC1	0	0	0	0	0	0	0	0	0	0	0	GND	0	0	0	0			
MAIN	IC2	0	0	0	0	GND	0	0	0	0										
MAIN	IC3	0.8	1.4	1.6	1.8	4.0	2.0	2.0	2.0	GND										IC-2E only
PLL	IC1	5.0	1.6	0	0	0	0	0	0	0	0	4.4	0	4.4	0	0	0	0	GND	f=145MHz
PLL	IC2	0	4.4	1.2	5.0	5.0	0	0	2.4	GND										
PLL	IC3	0.9	1.4	1.8	0	5.0	0	2.4	2.4	GND										
TOUCH TONE	IC1	6.1	5.7	6.1	6.1	6.1	GND	0	6.1	6.1	0	0	0	0	0	4.4	0			IC-2AT only

## IN RECEIVE MODE

UNIT	IC No.	PIN No.																		REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MAIN	IC1	4.2	5.0	5.3	5.6	0.9	0.9	1.1	5.6	2.9	2.0	2.1	GND	5.1	0		2.0			
MAIN	IC2	6.1	4.3	7.6	3.6	GND	3.6	3.6	3.4	3.4										SQL OPEN
MAIN	IC3	0	0	0	0	0	0	0	0	GND										IC-2E only
PLL	IC1	5.6	1.6	0	0	0	0	0	0	0	0	4.4	0	4.4	0	0	0	0	GND	f=145MHz
PLL	IC2	0	4.4	1.2	5.0	5.0	0	0	2.4	GND										
PLL	IC3	0.9	1.4	1.8	0	5.0	0	2.4	2.4	GND										
TOUCH TONE	IC1	0	0	0	0	0	GND	0	0	0	0	0	0	0	0	0	0			IC-2AT only



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